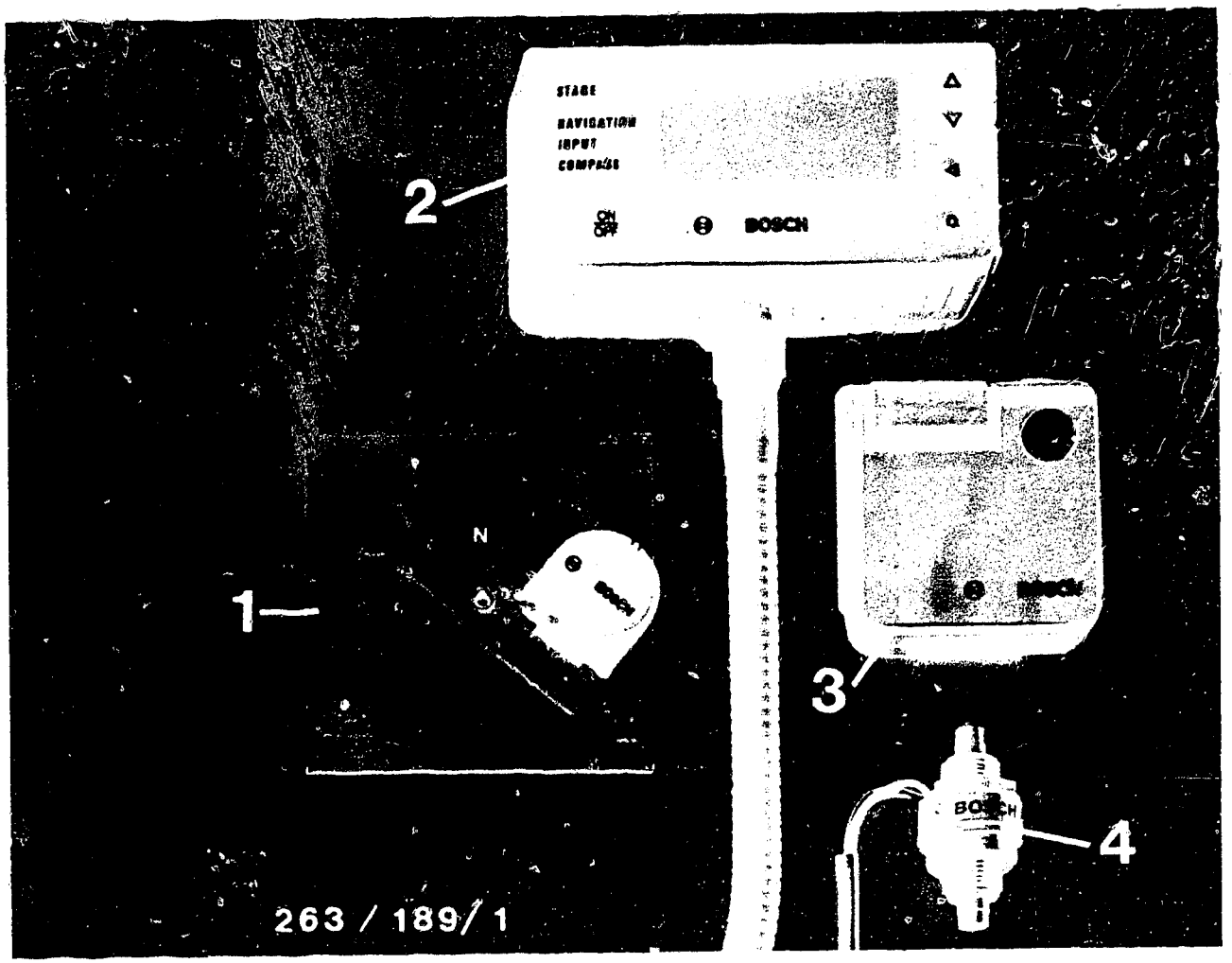
NEW SYSTEM 01.1987

CAR PILOT 0 263 002 900 0001 En

Navigation system

1 = Polar-coordinate measuring device
2 = Operating and display unit
3 = Geomagnetic-field sensor
4 = Distance-pulse generator



As of the start of 1987, Bosch has been supplying a navigation system which can be retrofitted in passenger cars. The navigation system consists of the following components:

* Navigation computer with integrated operating and display unit
* Electronic geomagnetic-field sensor
* Distance-pulse generator
* Polar-coordinate measuring device

When discussing navigation systems, a basic distinction is made between location and guidance systems.

CAR PILOT is an autonomous location system, which assists the driver in finding a goal located in unfamiliar surroundings by indicating direction and straight-line distance, taking into account the specified route.

The use of highly-integrated circuits and the latest technology for the display, computer, and sensors has resulted in a compact device.

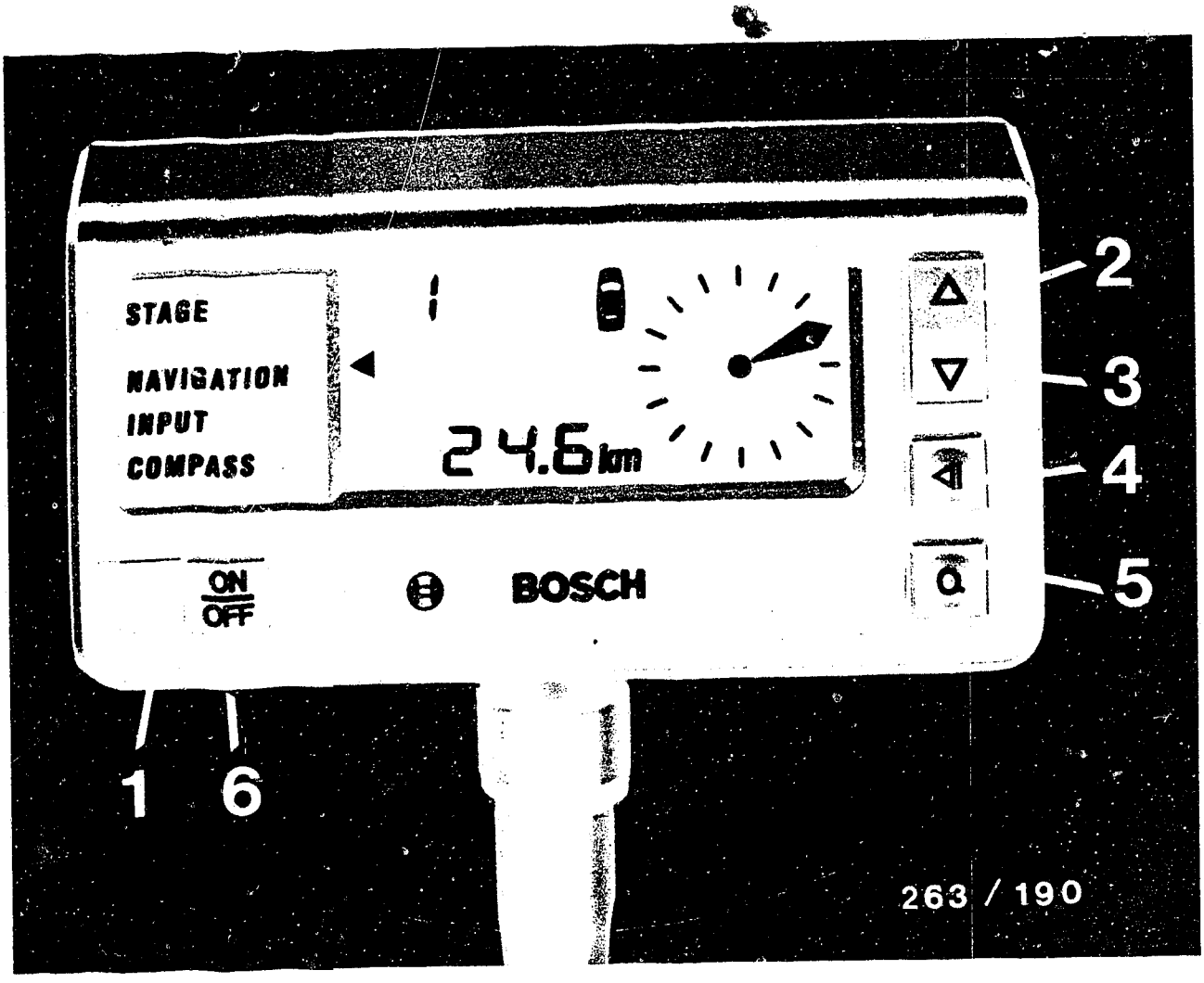
Navigation computer:

The heart of the navigation computer is a powerful microprocessor system with 16 k-bytes of program memory.

This computer controls the magnetic-field sensor, processes its PWM (pulse-width-modulation) signal, and determines an angular value which gives the deviation of the direction of the longitudinal vehicle axis with respect to magnetic north.

Further, the distance travelled is calculated from the signal of the distance-pulse generator.

Using these two computer results, it is possible to determine the direction and straight-line distance to the selected goal from the starting position.

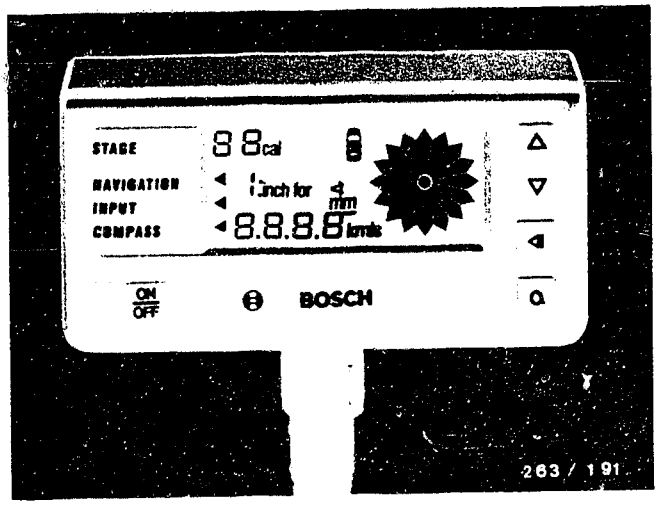


1 = On/off button
2 = Top pressure point of rocker for enlarging numbers during input
3 = Lower pressure point of rocker for reducing numbers during input
4 = Button for advancing the menu cursor
5 = Acknowledge key for inputs and actions
6 = Switch-over US/metric

The CAR PILOT is operated with these 5 buttons. The rocker switch is used to enlarge or reduce numerical values. Time control makes it possible to rapidly reach the desired numerical value.

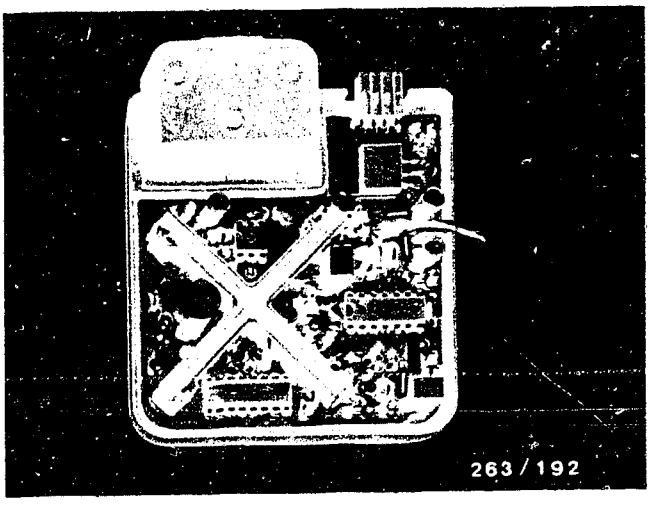
Switch-over from the metric to the imperial (US) measuring systems is done with a sliding switch on the bottom of the housing.

Operating and display unit



Information output is via a liquid-crystal display, which presents the data in characters and symbols with seven-segment displays (upper illustration).
The menu cursors indicate the selected function. The function "calibration" (cal) not listed in the menu is selected with the menu key and rocker switch (simultaneously).

Magnetic-field sensor (MFS) opened



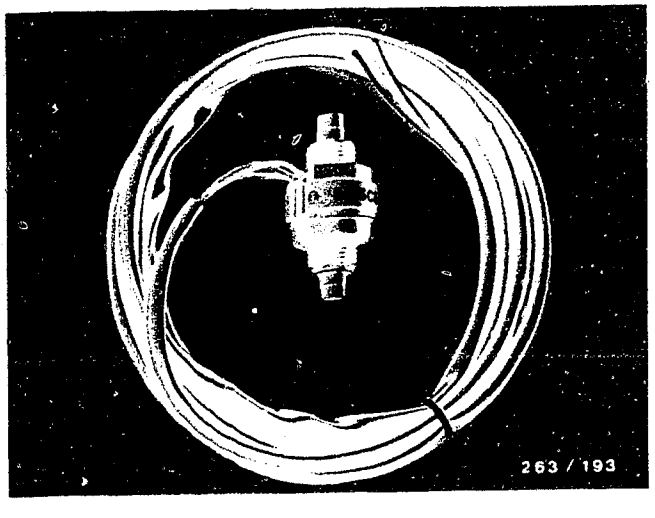
Magnetic-field sensor (MFS)
The core is made up of two cylindrical coils crossed at exactly 90°. The central computer p.c.b. assumes control of the magnetic-field sensor and the evaluation of the pulse-width modulated signal.

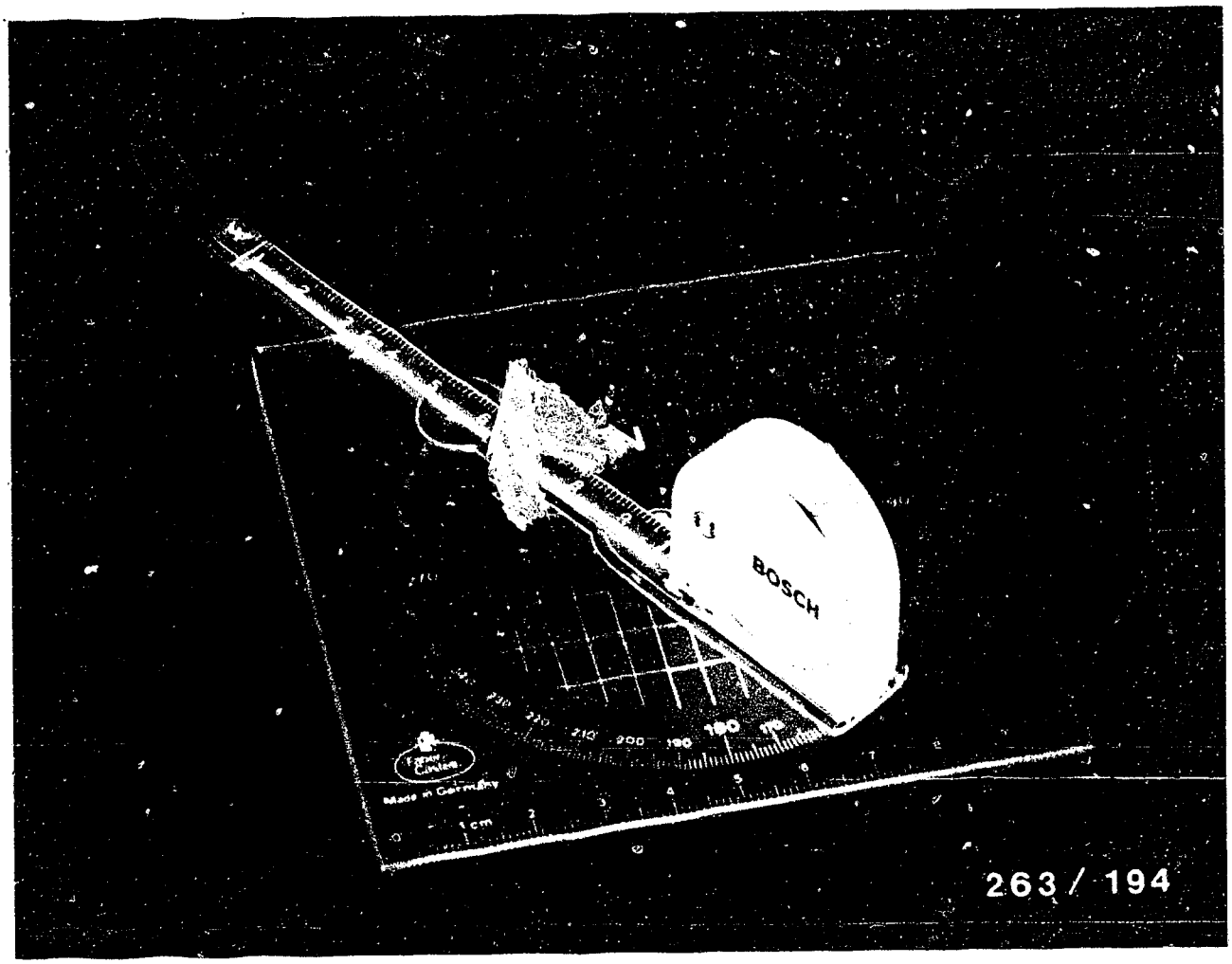
The sensor is located in a housing with articulated base, which allows position adjustment in three axes. A fluid level in the housing cover facilitates horizontal mounting.
Since every vehicle has its own unique magnetic field, the following locations may be suitable for installation of the sensor:

* Vehicle roof
* Trunk lid (inside)
* Rear window shelf
* At the top of the rear window or on the windshield above the rear-view mirror

Distance-pulse generator:

The input circuit of the navigation computer is designed for the evaluation of distance pulses in such a way that generators with reed contacts, photoelectric barriers, Hall probes, or inductive pickups can be connected. (Limitation with inductive pickups: Minimum 200 mV ss at a speed greater than or equal to 2 km/h)





Polar-coordinate measuring device:

An angle-measurement disc with an extendable measuring tape is used for measurement.
The measuring device is laid on the map in such a way that the center point of the angle measurement disc coincides with the stage starting point. The angle-measurement disc is lined up with geographic north, and the measuring tape folded out and lined up with the stage target point. The polar coorindates can then be directly read off and programmed in.

Calibrating the system in the vehicle:

Since the CAR PILOT can be installed in different vehicles, it must be calibrated for the individual car.

Using the calibration menu, the following operations can be performed:
* Location of a suitable installation position for the magnetic-field sensor.
* Compensation for the vehicle's own magnetic field.
* Determination of the distance-travelled characteristic number of the vehicle.
* Determination of the angular error arising through the installation of the magnetic-field sensor and local deviations in the geomagnetic field.

Determining a suitable installation location:

In calibration menu 1, the system first shows the horizontal component of the magnetic field at this point in A/m. The value should not exceed 50 A/m when driving in a circle.

More exact information on the usability of an installation location is provided after magnetic interference field compensation and switchover to the "compass" menu.

Magnetic interference field compensation:

Compensation for the vehicle interference field is done by driving the vehicle through a complete circle.
The circle should be as horizontal as possible and not in the vicinity of large iron objects (trucks, bridges, etc.). The direction of travel is unimportant, but it is important to turn the steering wheel all the way when driving the circle.
The vehicle should not be stopped while driving in the circle, and the circle should be entered when the car is already at speed, and exited in like manner; however, an extra quarter-circle is not critical. After completing the circle, the acknowledge switch must be pressed, which causes the cursor to disappear. The unit carries out compensation calculation during this time.

If "ON" or "OFF" flashes after calculation, the calibration is OK. If the circle is unsuccessful, one of three possibile faults will be displayed:

* Fault 1: Complete circle not driven.

* Fault 2: Poor installation location.

* Fault 3: A power-consuming device was switched on/off during the drive, or the vehicle was moved after "switchover" of the consuming device.

After acknowledging the fault, if any, the arrow rosette will flash again to signal readiness for a new circle.

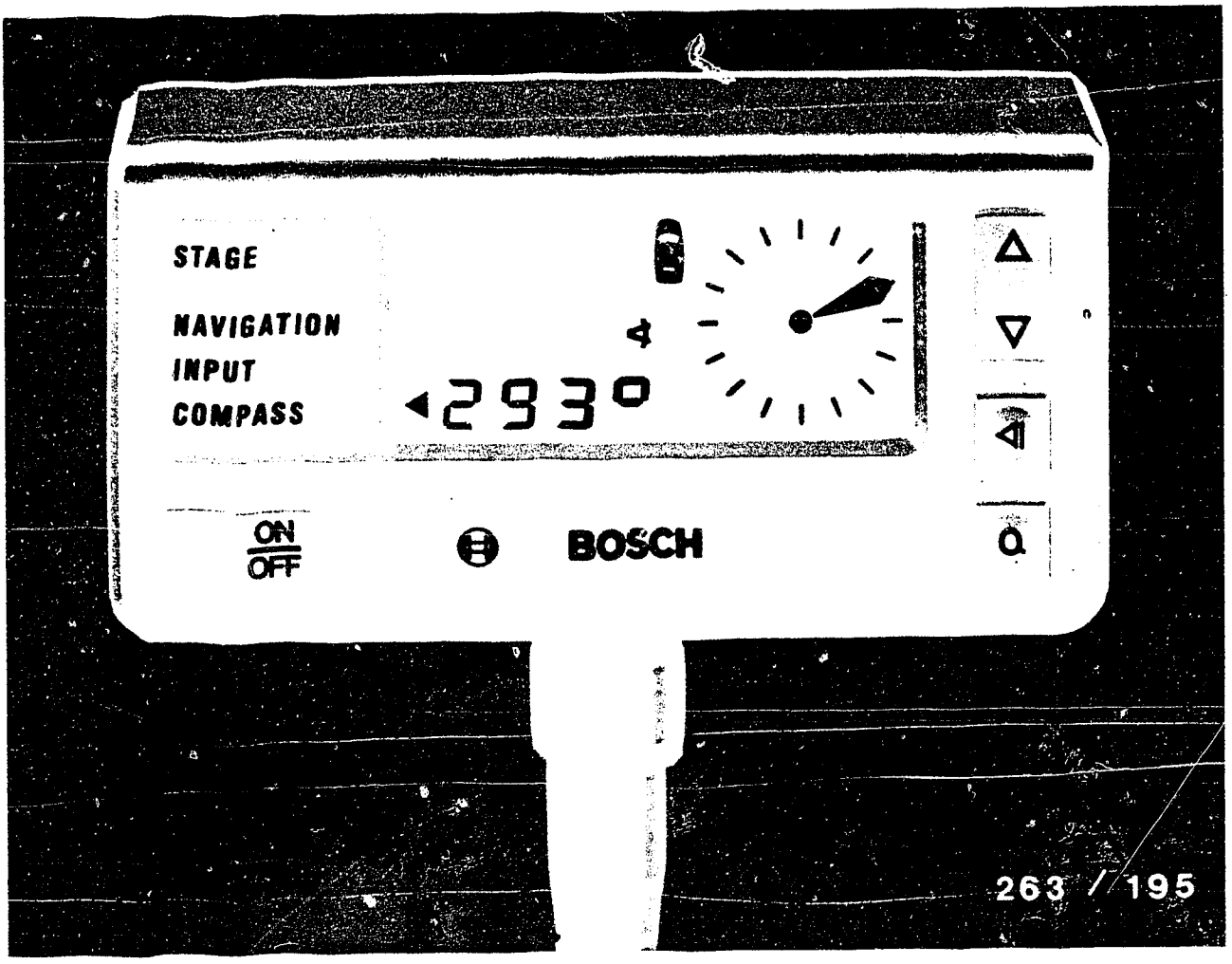
Consuming-device compensation:
In some vehicles, it is impossible to find a position for the MFS which is completely free of influence from electrical power consumers. Usually, a heavy consumer, such as the rear-window defroster or the stop lamp, will cause interference.
Compensation can be made for this influence by connecting the consumer to an input of the navigation system provided for this purpose.
After successful completion of a circle, the display indicates the condition of the consumer input by flashing ("OFF" or "ON"). The consumer must then be "switched over" (for example, depress the brake pedal if the consumer = stop lamp). The message on the display ("ON" or "OFF") can then no longer be seen flashing.

After about 5...10 seconds, calibration is ended if the consumer was not switched during measurement. Otherwise, fault 3 will be shown on the display. After acknowledgement, a repetition of consumer compensation is possible. Compensation is broken off by pressing the menu key.

Determining the distance and angle characteristics:

After interference-field compensation, the distance characteristic of the vehicle must be determined and the installation angle error of the magnetic-field sensor corrected. This is done with a calibration drive to a known point about 10 km away.
In calibration menu 2 (rocker down and menu key), the flashing upper rosette half prompts the operator to undertake the calibration drive, which is started and ended in motion by acknowledgement. The flashing distance number shown after the drive is changed to the actual value (e.g. trip odometer) by means of the rocker. After acceptance (Quit), the system calculates the distance characteristic and shows it with the designation "C" before the number.

After acknowledgement, the system calculates the direction between the starting and end points of the calibration route. This flashing value is changed to the value derived from the map with the polar-coordinate measuring device and used as the angle value. The system then calculates the new angle characteristic and shows it with a "C" as identification. Direct programming of the two characteristics can then be carried out in an abbreviated menu run. If no travel pulses are detected, the system skips the calibration trip phase and the distance and angle characteristics can be directly adjusted (e.g. after changing from summer to winter tires).



Compass function:

The "compass" function can be selected when the cursor points to the corresponding word. The rosette arrow points in the direction of geographic north. The character display shows the angle which the vehicle longitudinal axis must form with north (course angle).

Example: Arrow points left, display points to 90°, in in other words, as seen from the direction of travel north is exactly to the left while the vehicle is moving in an eastward direction.

Input:
The input menu is used to input into the system the data taken from the map material.
Normal, undistorted maps with a known scale can be used. The scale must lie within a range of 1:10,000 to 1:1,000,000. A number can be raised or lowered by 1 by brief operation of the rocker. Longer pressure on the rocker causes an increase/reduction in steps of 10. A maximum of 10 routes with 9 stages each can be input. The straight-line distance from the starting point to the target and the angle formed by this line with respect to north are input.
Important: When programming several stages, the target point of one stage forms the starting point of the stage following.

Input sequence:
After selecting the input function, the numeral 1 will flash on the top left. The stage to be input can be determined by changing this numeral. The two-digit stage number has as its first character the route number and as its second character the appropriate stage number.

The number is accepted by "Quit". Subsequently, in the metric operating mode the scale display flashes, e.g. 1:50 T or 1 inch for 0.79 miles. This scale can be altered to the scale of the map used if it is not the same. During input, the mode can be switched between metric and US.

If the scale is changed, after acknowledgement all following stages of the route are cancelled and the new scale for the following stages (up to and including stage 9) is accepted.
Once the scale has been accepted, the next thing that must be done is to input the route length determined on the map. This is done by changing the number value shown with the "mm" unit. Possible values extend from 0 to 400 mm. If the route length is input with "0" mm, the system cancels all following stages of the route. The value is likewise accepted after acknowledgement, which causes the unit to then advance to input of the angle value likewise measured from the map.

After inputting the angle in the same manner, the number of the next stage to be input will appear in the input display. This stage can now be input as already described.

If the highest stage number of a route has been reached, the "Quit" button cannot be used to advance to the next route, since the 10 routes can all have different starting points. Advancing to input of the next highest route number is done with "rocker up".

By lowering the stage number and repeating the run, it is possible to again view the data that have just been input, and to correct them if necessary.

Note:
If several stages have been input (e.g. 8) and a stage with a low number (e.g. 4) needs to be altered (scale, distance, or angle), the following stages (in this case, 5 to 9) are cancelled if the scale is changed or the distance input with 0 mm.

Linking routes:

The navigation system allows routes to be connected so that the maximum total length corresponds to a multiple of 9.
Two routes can be linked when the ninth stage is programmed, i.e. the distance of the ninth stage is not input with 0 mm.

Example:

If the ninth stage of a route (e.g. 19) has been programmed, the following route (here 21 to 29) is linked with the previous one (11 to 19).

This means that it is possible to skip target 19 from stage 18 and to drive to target 21. This would not be possible without linking, since then starting point 20 (identical with target point 19) would have to be acknowledged.

The reading device (polar-coordinate measuring device) provided with the system is a valuable aid in determining data from the map material.

Proceed as follows:

* Point the zero-degrees indicator on the scale exactly towards north, while the point of origin of the distance rule lies exactly at the starting point.
* Point the distance rule at the target and read the distance in millimeters.
* Read the angle on the scale of the angulometer.

It is also possible during a navigation trip to input the distance not yet travelled. During input, the vehicle position is continuously calculated, as long as the just-travelled stage is not input/changed. If this stage is changed, the trip must be restarted in the navigation menu.

NAVIGATION

The "Navigation" menu is selected by the "Menu" key. The data required for navigation appear on the display:

At the top left is the number of the stage just travelled. The 4-digit number shows the straight-line distance in km or miles, and an arrow on the right shows the direction to the target.
The small car symbol shows the relationship between the longitudinal vehicle axis and the arrow.

During navigation travel, three possibilities exist for route selection:

* With "rocker up" the next stage (press one time) or the next route (hold down or press one time in stage 9) can be selected.
* With "rocker down" each stage of the specified route can be selected (for example, to see the straight-line distance already covered).
* With the "Quit" key, the next stage (with reference to the target) can be selected after reaching the target, and any errors can be eliminated.

When the vehicle enters a target circle, which is a circle around the target point with a radius of 3% of the distance covered since the most recently acknowledged stage target, the rosette and direction arrow flash alternately. This means that the target area was reached within the parameters of system accuracy.

If the driver has target contact, he can switch over to the next stage target by pressing the acknowledgement key. At the same time, any errors that have occured up to this time are eliminated by acceptance of the programmed coordinates.

If the driver does not wish to drive to a stage target, he can use the rocker to advance to the next stage target. The CAR PILOT now calculates the new location at the time of switchover, and with it also the distance and direction to the next stage target. However, the errors that have entered the calculations up until that point remain. The navigation system allows the linking of routes so that the maximum total length corresponds to a multiple of 9.

SELF-TEST:

The navigation system is able to carry out self-testing. It is not possible to continuously check all functions during operation. For this reason, self-testing is divided.

The following are continuously monitored:

* Magnetic-field sensor and quality or correctness of magnetic-field calibrations

Each time the voltage supply term. 30 is applied, the

* Read/write memory (RAM) is tested.

Each time the system is switched on, the test for
* Read-only memory (EPROM) is carried out.

In addition, the test menu can be called up to test the following:
* Display,
* Nonvolatile read/write memory (EEPROM)
* Distance sensor.

To do this, the four keys
"UP","MENU","DOWN","QUIT"
must be pressed and released again in precisely this sequence in the compass menu after the system is switched on but before any other key has been operated.

After this key sequence, the cursor is blanked out and the word "CHEC" flashes.
By pressing the "Menu" key, the procedure is aborted.
All display elements in display are actuated by pressing the "Quit" key.
After a repeat acknowledgement, the word "CHEC" appears for about 2 seconds on the 7-segment display. During this period the EEPROM is checked. If the test is successful, the unit then shows "Corr", and if not it shows the error that has appeared.
Acknowledgement leads to testing of the supplementary input. The display shows the condition at the input of the navigation system "On" or "Off" of consuming device). Switching on or off of the consuming device must result in a change of the display.

The distance-pulse display is reached by acknowledging the display. The display shows "0000", if no distance pulses are present.
The test can be aborted by pressing "MENU".

If the "DOWN" key is pressed and held down during distance-pulse display, and the "QUIT" key is pressed simultaneously, after about 5 seconds the word "BYE" will flash on the display.

Note:
If acknowledgement is done agair, all data are erased, even those in the EEPROM. The next time the system is switched on, it will act as if it had never been calibrated!

Help menu and error display

Press the "QUIT" key 5 seconds in the compass menu. The work "HELP" will then flash in the seven-segment display, and will disappear again after acknowledgement.
If there is a system error, it will be shown after the "QUIT" key is pressed the first time. Otherwise, the first system parameter will be output.

The following errors can be shown:

ERROR NUMBER	TYPE OF ERROR
1	Complete circle not driven
2	Poor installation position
3	Consuming device was switched during circle or vehicle was driven during subsequent measurement
4	Magnetic-field sensor providing meaningless measurement values (can also happen within the first minute after the unit is reconnected to the battery)
5	Magnetic-field sensor is not connected or has a loose contact
6	Non-assigned
7	EEPROM error
8	RAM error
9	ROM error

Any error that may have appeared is deleted only after the unit is switched off (except for 1, 2 and 3).

Errors 7, 8, and 9 are erased only after disconnecting the voltage supply at term. 30.

Published by:
Robert Bosch GmbH
Division KH
After-Sales Service Department
for Training and Technology (KH/VSK)
Please direct questions and comments
concerning the contents to our authorized
representative in your country.

FIAT UNO DIESEL 03.1987

with engine 127 A 5 .. 1.302 l 0003 En

Complaint of "constant bucking during driving"

If the complaint "constant bucking during driving" occurs with this vehicle, an improvement can be made by installing flat-type pintle nozzle

0 434 250 145 (DN 12 SD 283)

instead of the flat-type pintle nozzle 0 434 250 119 (DN 12 SD 1750) installed as standard.

Set the nozzle-opening pressure to 125 +8 bar. After conversion, mark the nozzle holder with a spot of yellow paint on the holder.

Replace the nozzles in sets. This work is not to be free of charge.

Responsible:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

1. General

The KE-Jetronic, first supplied from series production the fall of 1982, has gained wide application. KE-Jetronic is, as is generally known, a further development of K-Jetronic.

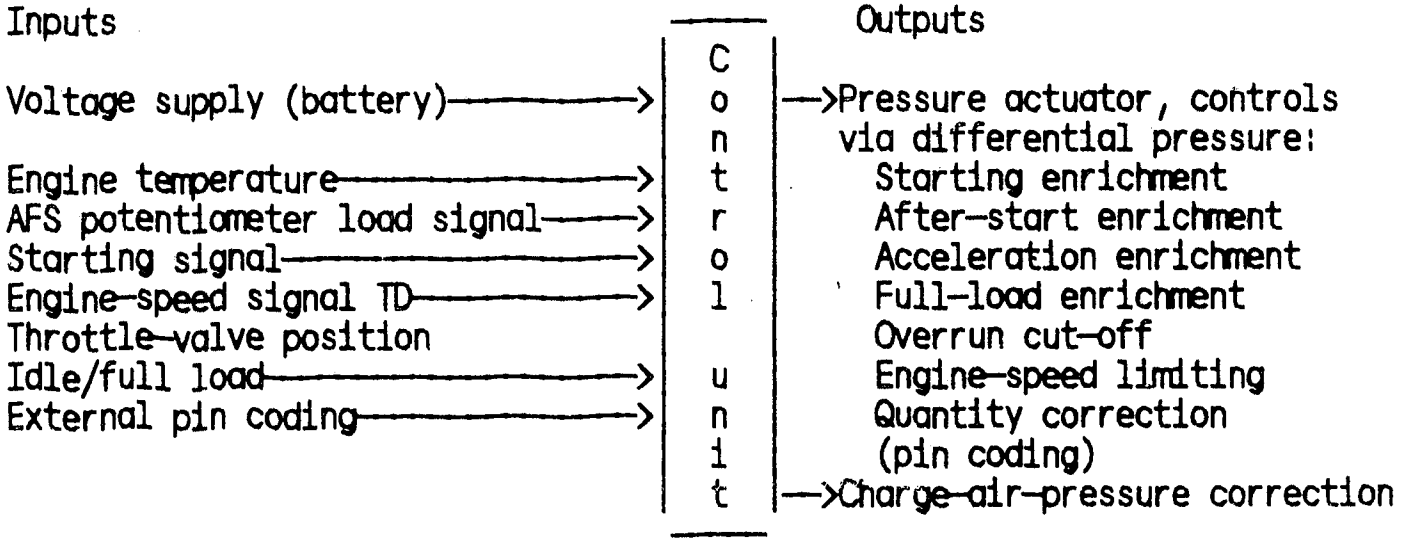
The basic hydraulic/mechanical principle of the KE-Jetronic corresponds in large degree to that of the K-Jetronic, except for some changes in details. On the other hand, all corrections required in actual use are made by electronic intervention, which considerably extends the flexibility of this system. These basic KE functional characteristics are described in detail in the Technical Bulletin "Neues Erzeugnis" VDT-I-438/3 De (En for English version) and in the Bosch Technical Instruction 2021.

Naturally, the development of a system with this much potential for upgrading did not stop with the first production series.

Adaptation to different engine designs, compliance with increasingly stringent legal requirements, consistent consideration of environmental protection concerns, and functional extensions have led to various system generations of KE-Jetronic, which are identified as system versions KE 1, KE 2, and KE 3. Further, these system versions are divided into variants, for example KE 2.1, 2.2, 3.1, 3.2 etc.

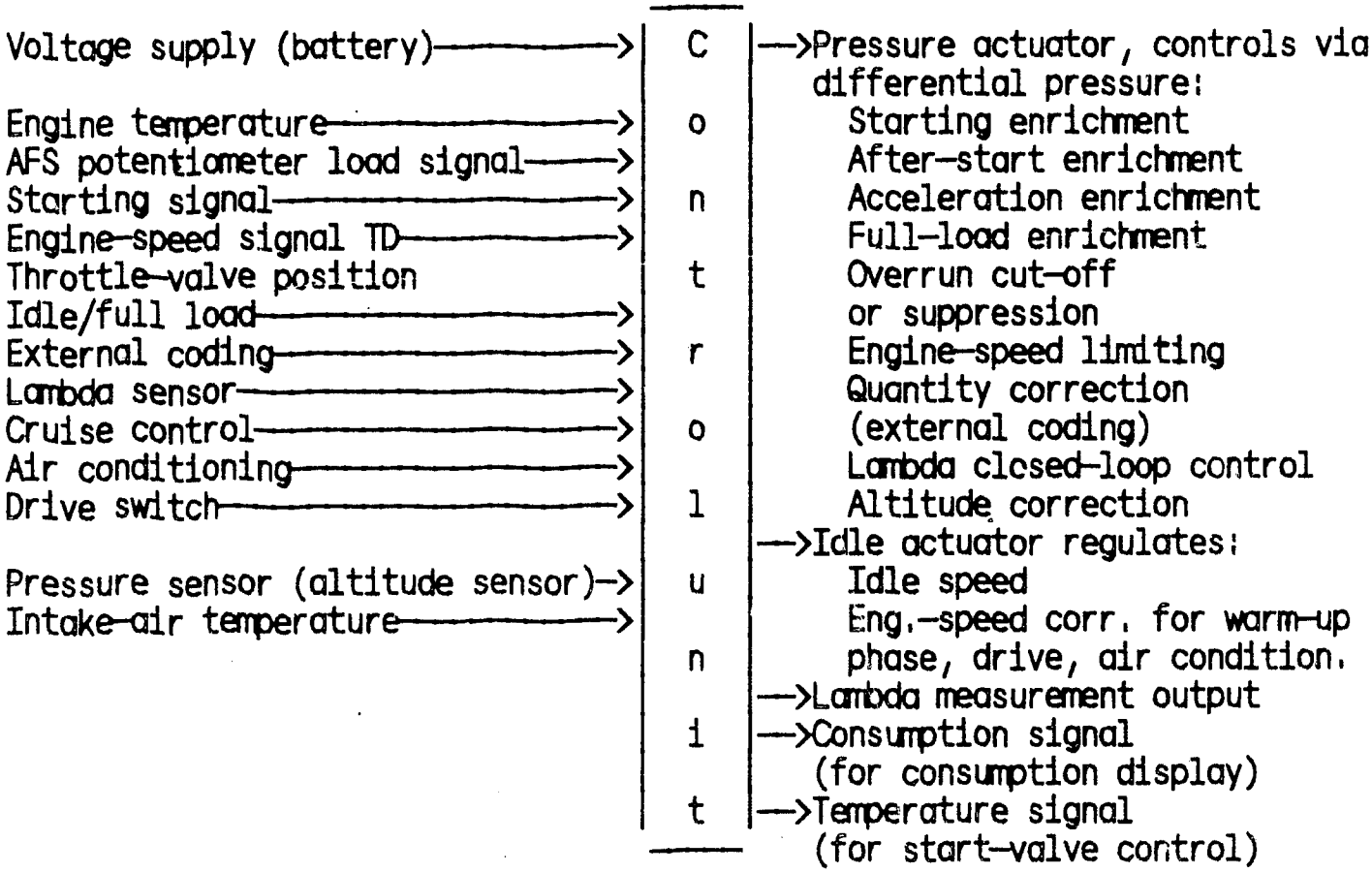
In the following, the differences between the individual system versions will be explained in greater detail.

2. KE 1 – Scope of control-unit functions:



KE 1 contains purely the basic functions of fuel injection corresponding to the above table. The engine-speed limiting and charge-air-pressure control functions are not general, but are provided only for certain vehicle types (variant KE 1.2).
The control unit of the KE 1 uses analog circuitry.

3. KE 2 – Scope of control-unit functions:



The KE 2 system version carries out the basic functions of the KE 1 as described, and supplements them with lambda closed-loop control and/or low-idle-speed control (LFR), as well as further special functions per the table, depending on the vehicle version.

KE 2 control units are for the most part equipped with 2 PC boards, with the LFR portion using digital circuit logic.

Functions differing from or in addition to KE 1:
Lambda closed-loop control:
In systems with lambda closed-loop control (lambda = 1), the total control stroke requires a displacement of the the current characteristic curve with a warm engine to a mean value of approx. 10 mA, which also corresponds to the

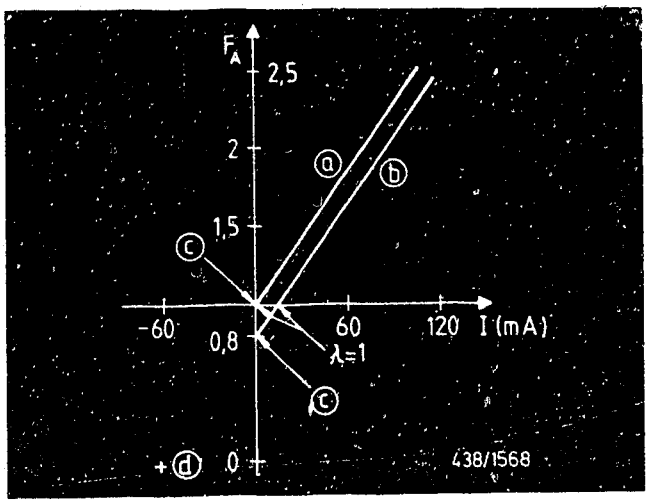
control value obtaining when, for example, the lambda sensor is defective. If there is an interruption in the current (current = zero), the result is a leaner mixture (lambda = approx. 1.25), i.e. limited limp-home ability (see characteristic curve on following page).

With systems without lambda closed-loop control, the pressure-actuator control current with the engine warm is exactly zero. This also corresponds to the operating conditions obtaining when the current supply to the pressure actuator is interrupted due to cable breakage or a fault in the control unit. Thus, good limp-home operation is ensured even in this condition.

Adjustment of the lambda closed-loop control (mixture-adjustment screw) is done either by current measurement

to the mean value per test specfications (e.g. 10 mA) or by voltage measurement (integrator voltage) if the appropriate test connection (control unit, term. 23) is present in the vehicle. In such a case, the mean value to be set must be determined with the sensor cable disconnected.

Comparison of KE 1 and KE 2 without/ with lambda closed-loop control:



F A = Enrichment factor
I Control current for pressure actuator (mA)
(a) = Without lambda closed-loop control
(b) = With lambda closed-loop control
(c) = Limp-home point (current interruption)
(d) = Overrun cut-off

Low-idle-speed control (LFR):

With KE 2, a two-winding rotary actuator is used as an idle actuator. This rotary actuator is located in the bypass leading to the throttle valve (in place of an auxiliary-air device). The basic function of LFR as well as the construction and method of operation of a two-winding rotary actuator are described in detail in Technical Bulletin VDT-I-2801 De (in German, En for English version).

The LFR is tested and adjusted by means of the on-off ratio (BOSCH lambda closed-loop control tester KDJE-P 600, or motortester). Correction to the specified value is made by adjusting the idle-bypass screw, which is located either directly on the idle actuator or in the bypass duct in the throttle-valve assembly, depending on the engine type. Depending on the vehicle, under certain operating conditions engine-speed corrections are necessary, which can result from the control-unit inputs engine temperature, air conditioner, drive switch, etc.

Overrun cut-off:

On vehicles with cruise control, it is necessary among other things to suppress the overrun cut-off when the cruise control is switched on. The control unit receives the appropriate information from the cruise-control input.

External coding:

External coding is generally done by connecting certain terminals on the control unit on the wiring-harness side (thereby permitting subsequent changes).

For example, a bridge from term. 15 to term. 2 (ground) can result in mixture enrichment by a certain amount in case of the disconnection of the bridge for the "acceleration enrichment" operating condition.

In other cases, a control unit can be adapted to different types of engines through appropriate external connection.

In cases where external coding has an influence on the location and elimination of faults, it is taken into consideration on the corresponding SIS microcard.

Further control-unit output signals:

Consumption signal: For exact consumption determination, for example by an on-board computer, the air-flow-sensor potentiometer signal is processed in the control unit and passed on to the consumption output.

Temperature signal: With certain types of vehicles, the start-valve actuation is not done by a thermo-time switch, as is usual, but rather by an additional circuit in the electronics triggering relay for the electric fuel pump. The required temperature signal is supplied to the relay as an analog voltage value through the temperature output of the control unit.

The differences between the KE 2 variants (KE 2.1, 2.2 etc.) will not be considered at this point, as the primary subject of this section will be the internal control-unit differences.

4. System version KE 3 with its variants KE 3.1 and KE 3.2 represents a further stage of KE development.
The KE 3 uses a fully-digital control unit with microprocessor for gasoline injection and idle-speed control. The overall circuitry consists essentially of internal control-unit voltage stabilization (reference voltage 5 V), the microprocessor, and input and output assemblies.

The reference voltage is available for the supply of the digital IC, the external components AFS potentiometer and pressure sensor (altitude sensor), as well as for other consuming devices, e.g. electronic ignition system.

In the input assemblies, the analog and digital input signals are converted into analog/digital convertor- and computer-compatible signals, and supplied to the microprocessor. In the microprocessor, appropriate control signals are generated for gasoline injection and idle-speed control, and output to the corresponding output assemblies.

4.1 Basic functional characteristics of the KE 3 control unit:

---

* Plausibility testing:

  If the control unit acquires an extreme, i.e. implausible, value, this value is replace by a fixed value.

  This applies to the following inputs:

Engine temperature Intake-air temperature Altitude sensor Idle-speed and full-load switch Engine-speed signal TD Load signal (AFS potentiometer) Idle-speed and full-load switch	Example: Engine temperature signal -40°C (e.g. NTC lead interrupted): Substitute value = +80°C

* Start recognition using engine speed:

Starting is detected within a certain engine-speed range, and not by terminal 50 of the starting switch or terminal 15a as with KE 1 and KE 2 respectively:

Lower start recognition speed (beginning): approx. 30 min-1
Upper start recognition speed (end): approx. 500 min-1

* Steady (quiescent) current:

After switching on the ignition, a certain current (pressure actuator) is set. This value is deleted the first time the lower start recognition engine speed (approx. 30 min-1) is exceeded.

* Low-idle-speed control (LFR) (where present):

With KE 3, LFR 3 is used. The idle actuator is a single-winding rotary actuator. A pulsing direct current is applied to the actuator winding, generating a torque at the rotating armature. This torque is counteracted by the force of a return spring.

If the on-off ratio changes, the position of the rotating armature changes and thus the position of the rotary slider which determines the air quantity. In order to prevent the battery voltage from having influence on the actuator opening cross-section, voltage fluctuations in the vehicle electrical system are compensated for by the control unit.

The low-idle-speed control works independent of engine speed and loading. Load recognition is by the signal of the air-flow-sensor potentiometer.

* Air-flow-sensor (AFS) potentiometer:

The load-dependent closed-loop characteristic-map control used with KE 3 for injection and the load-dependent LFR place very high accuracy demands on the potentiometer. For this reason, there is an additional fine-adjustment potentiometer (trim potentiometer) on the potentiometer housing for exact factory adjustment.

The potentiometer must not be changed by after-sales service, since the required accuracy of adjustment is not possible with the equipment generally found in workshops. Corrections to the trim potentiometer are possible under certain preconditions.

* Lambda closed-loop control:

The circuitry of the control-unit output stage of the KE3 makes possible current polarity reversal in the closed-loop range, so that the mean or control value for lambda = 1 can be set at 0 mA. This makes possible good limp-home characteristics even if the current is cut off (e.g. cable break).

The total control range for lambda closed-loop control lies in the range of approx. – 10 mA to + 15 mA.

Aside from special application-specific features of no relevance for after-sales service, the extent of functions of lambda closed-loop control corresponds basically to the KE 2. Special features having an influence on the test sequence are taken into consideration on vehicle-specific SIS microcards.

4.2 Special features of the KE 3.1 – Jetronic variant (applies to all Daimler-Benz vehicles with KE3, for example)

Control unit with 25-pin edge connector as for KE1 and KE2.

The functional scope corresponds essentially to the total scope of KE 2, (see table).

With KE 3.1, there is a separate adjustment plug as external coding. This plug allows characteristic-map corrections in certain operating ranges depending on the plug position (MKV plug). For the assignments of the individual plug positions see the appropriate SIS microcard.

There are 3 control-unit versions:

* Pure ECE version without lambda closed-loop control. MKV plug for 7 plug positions.

* Multi-functional version (MF system) for catalytic-converter conversion cars. Two characteristic maps are stored in the control unit, one for CAT operation with lambda closed-loop control, one for operation without CAT and without lambda closed-loop control. The respective map is activated by changing the external MKV adjustment plug with the appropriate labelling "KAT" or "ECE". Both MKV plugs for 7 plug positions.

Note:
The system known under the general heading "multi-function fuel induction" also includes the ignition system. Here, another adjustment plug makes it possible to adjust for the different fuel types, unleaded premium or normal and leaded premium or normal.

* Pure CAT version for countries where catalytic converters and lambda closed-loop control are required for all vehicles (US, Japan). MKV plug for 6 plug positions.

With the KE 3.1, a pulsating d.c. voltage (on-off ratio) is output at the lambda measurement output. This is used both to adjust the lambda closed-loop control and as the output signal for simple self-diagnosis.

Self-diagnosis:

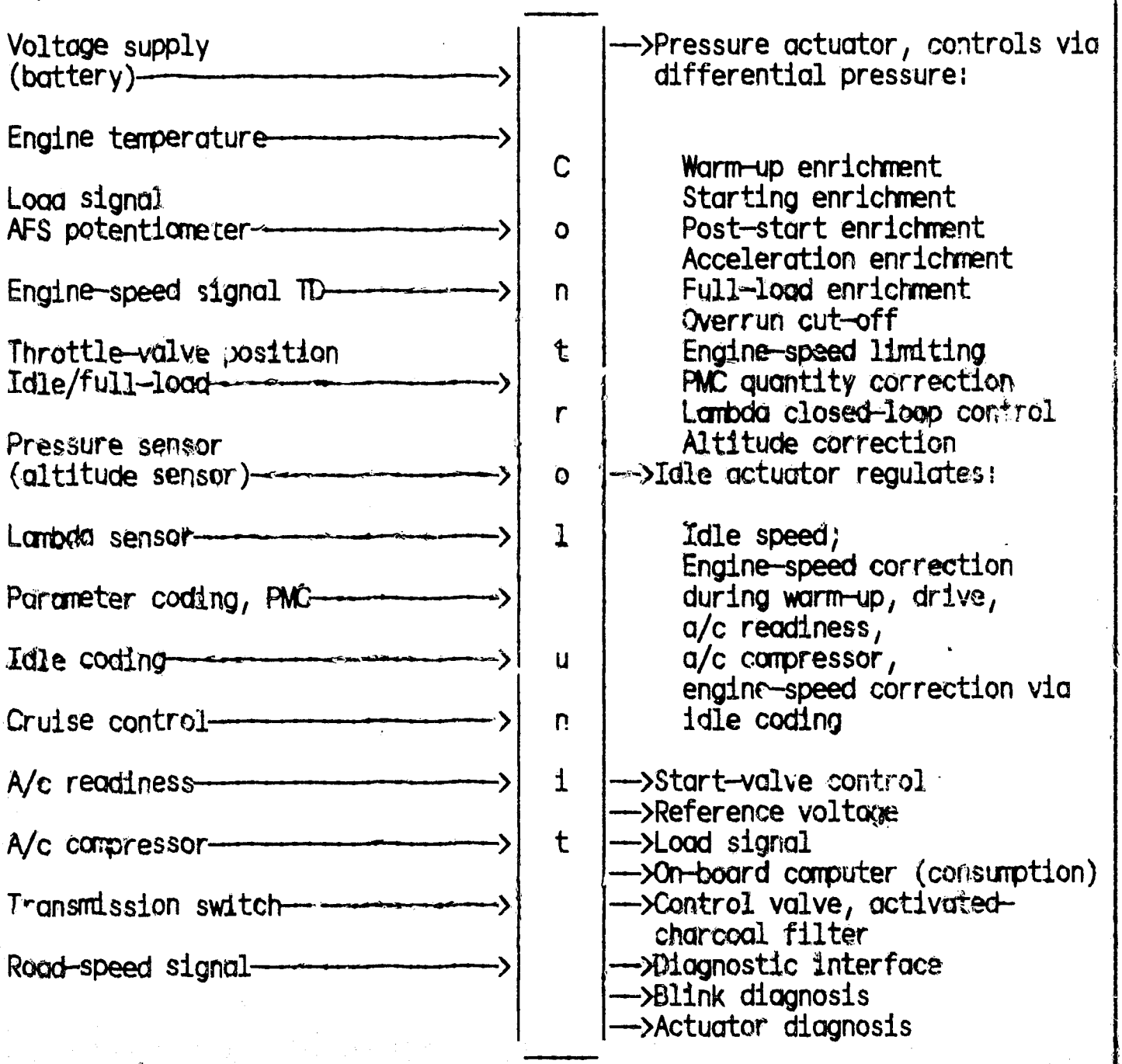
Certain system faults cause a corresponding on-off ratio to be output. Fault output has priority over the output of the lambda closed-loop control signal, i.e. when there is a fault, lambda adjustment by means of the on-off ratio is not possible.

KE 3.1 self-diagnosis fault table (example)

On-off ratio in %	Possible cause of trouble
0	ECE: Not assigned. Lambda (KAT): Control-unit supply interrupted, open circuit in diagnosis lead, mixture setting too rich
10	1. Incorrect function of one or both idle switches. 2. Incorrect signal from AFS potentiometer
20	Full-load switch closed at insufficient air flow rate, short circuit
30	NTC-engine or NTC-lead defective
40	AFS potentiometer defective, open circuit in lead, short circuit
50 static	ECE: No fault present. Lambda (KAT): Lambda sensor defective, too cold, sensor lead interrupted.
60	Not assigned
70	No or incorrect TD signal
80	NTC-air or NTC-lead defective
90	Alt. sensor defect. - open circuit, short circuit
100	ECE and Lambda (KAT): If 100% and simultaneously idle speed too high (1800 min-1): Control-unit voltage supply defective. Lambda (KAT) only: Mixture setting too lean. Sensor or sensor lead short-circuited to ground, control unit defective
Oscill. display	Only with lambda (KAT): No fault present; closed-loop control operation.

4.3 Special features of KE 3.2 – Jetronic variant (applies to AUDI 5-cyl. engine, for example)

KE 3.2 – Scope of control-unit functions:



The KE 3.2 is the first version with a control unit having a 35-pin edge connector.

Common acquisition and evaluation of input signals mean that the KE 3.2 has a direct functional correspondence with the electronic ignition system EI 127 K with knock control.

Both systems have a common diagnosis system with fault output through blink code and with fault memory. In addition, there is a common interface for both systems (term. 1 of the KE control unit). With this interface, fault readout using a diagnosis computer is possible at a later time.

There is an additional actuator diagnosis for acoustical or optical testing for the components pressure actuator, idle actuator, start valve, and control valve for activated charcoal filter.

Description of functions specific to KE 3.2:

Parameter coding (PMC):

The external connection of certain control-unit terminals via an edge connector makes it possible to correct the characteristic map or individual operating points, with the number 1 in the following table corresponding to the basic adaptation. Higher numbers correspond to fixed adaptation factors.

Coding inputs on the control unit:

PMC 1 = term. 20, PMC 2 = term. 2,
PMC 3 = term. 22, PMC 4 = term. 9

Coding in 8 stages for the functions:

TV = Lambda-TV (lambda shifting)
KF = Characteristic map
WL = Warm-up enrichment
BA = Acceleration enrichment

Parameter coding (example):

PMC 1	PMC 2	PMC 3	PMC 4	TV	BA	KF	WL
1	1	1	1	1	1	1	1
0	1	1	1	2	1	1	1
1	0	1	1	3	1	1	1
1	1	0	1	1	2	1	1
0	1	0	1	2	2	1	1
1	0	0	1	3	2	1	1
X	X	1	0	–	1	2	2
X	X	0	0	–	2	2	1

Connection with ground bridge:
1 = open 0 = ground X = as desired

Note:
PMC 4 only for models with lambda closed-loop control.

Low-idle-speed control (LFR):

See table for scope of functions. 2 control-unit inputs can be assigned for engine-speed correction when the air conditioner is running: Term. 32 = a/c readiness. The engine speed is increased to a certain value as long as the air conditioner is switched on. Term. 33 = a/c compressor. With automatic compressor on-switching the increased engine speed is kept constant.

Idle coding: Through external connection of the control-unit terminal 24 to ground, the basic idle speed can be increased by a fixed value.

Start-valve control:

The start valve is triggered by the KE control unit, and is activated during cold starting, after cold starting (post-injection), and during hot starting. The triggering signal is pulse-width modulated with a fixed clock frequency and variable on-off ratio.

Cold start:
Start of injection after exceeding the lower start-recognition speed. At low starting temperatures, long injection time, high on-off ratio
(e.g. – 25° C = 12 s/100 %, 0° C = 3 s/80 %).

Post-injection:
Start of injection after the upper start-recognition engine speed is exceeded, i.e. when the engine has started up. Duration of injection and on-off ratio dependent on temperature. Function only below a fixed limit temperature (e.g. – 10° C)

Hot start:
Function only after a certain (high) start temperature has been exceeded. Start of injection after the lower start-recognition engine speed has been exceeded and after a certain delay period. Constant on-off ratio, end of injection after exceeding the upper start-recognition engine speed.

Reference voltage:
In addition to the usual KE supply of the external components air-flow sensor potentiometer and altitude sensor, this signal also goes to the ignition-system control unit (evaluation of voltage ratio for altitude-sensor signal).

Load signal:
A processed load signal is provided to the ignition-system control unit by the KE control unit.

On-board computer:
A processed consumption signal is provided to the on-board computer by the KE control unit.

Control valve for activated-charcoal filter:

The fuel fumes from the fuel tank collected and condensed in the activated-charcoal filter are supplied through a valve to the engine induction tract. The valve is triggered by the KE control unit. At present, depending on the type of engine there are 2 different triggering versions:

* Valve opening 30 sec. after starting as long as the engine is running.

* The quantity of fuel returned is varied depending on the load and engine speed for coordination with the lambda characteristic map. Valve triggering is continuous with a pulse-width modulated signal with fixed frequency and variable on-off ratio.

Diagnostic interface:
Output terminal 1 of the KE control unit is the interface for future fault readouts for the fuel-injection and ignition section using a diagnostic computer.

Self-diagnosis through blink code:

Self-diagnosis is done for the fuel-injection and ignition systems. The ignition system has priority in fault output.

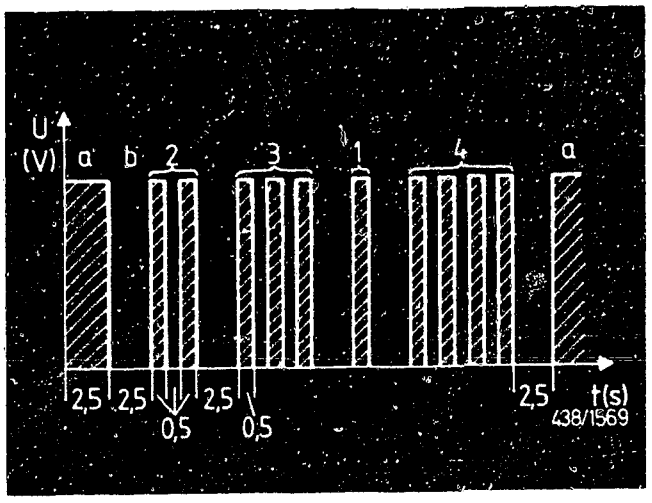
The diagnostic lamp is located in the instrument panel. Certain (safety-relevant) faults are indicated during the

period of their occurence by the diagnostic lamp. Faults in the system recognized by the diagnostics are stored as long as the ignition is switched on.

The diagnosis mode consists of 4 blocks each having a maximum of 4 blink pulses.

Diagnosis initiation (begin):
Bridge contacts at electric fuel pump relay with fuse for at least 2.5 s.

a = Start signal
(diagnosis initiation)
b = Pause before the first
block



Example using fault code 2314

Note:
Grid field means fault lamp ON.

After renewed diganosis initiation, either a further fault is output, or, if another fault is not present, diagnosis end is displayed:
Lamp in even rhythm 2.5 s on, 2.5 s out, until ignition is switched off.

Blink code – fault table (example):

Condition: Engine idling at normal operating temperature.

Before initiating diagnosis, drive the vehicle at least 5 seconds at an engine speed of at least 3,000 min-1. Do not switch off the ignition thereafter.

Fault code	Fault area
1111	Control unit defective (EI-K or KE)
2121	Idle switch (does not open)
2122	No eng.-speed signal from ign. system
2123	Full-load switch (does not open)
2141	Knock control at control stop
2142	Knock sensor or lead defective
2223	Altitude sensor or lead defective
2232	AFS potentiometer or lead defective
2233	Reference voltage interrupted
2312	NTC or lead defective
2342	Lambda sensor or lead defective
4341	Pressure actuator or lead defective
4343	ACF valve or lead defective
4431	Idle actuator or lead defective
4443	Start valve or lead defective
4444	No fault present
0000	End of fault output

Actuator diagnosis:

This includes the following actuators: Pressure actuator, idle actuator, start valve, and activated-charcoal filter valve (control valve for tank-ventilation activated-charcoal filter).

Initiation of actuator diagnosis:

Before switching on the ignition, bridge the contacts at the relay for electric fuel pump actuation with fuse. Remove the fuse no earlier than 2.5 seconds after switching on the ignition.
To test the start valve, the full-load contact must in addition be operated by hand.

The actuators are now triggered with different frequencies one after the other, after new initiation each time (start valve max. 10 sec.).

The actuators are evaluated acoustically (working noise) or optically at the pressure actuator by current measurement. Each triggered actuator is assigned a blink-code number for monitoring purposes.

Triggering sequence:	Code number:
Pressure actuator	4341
ACF valve	4343
Idle actuator	4431
Start valve	4443

5. Service concept:

With regard to the mechanical and hydraulic systems, testing is identical for all system versions.

For electrical/electrics testing, a basic distinction is made between two test concepts:

* Versions without self-diagnosis:
  System inspection with universal test adapter, working through the entire test chart of the appropriate SIS microcard.
  Test leads for test adapters:
  KE 1, KE 2 = 1 684 463 135
  KE 3.1 = 1 684 463 169

* Version with self-diagnosis:

Trouble-shooting is initiated in 2 ways:

a) Trouble-shooting through self-diagnosis if one or more faults are shown. Direct elimination of fault in functional path shown to be faulty with single test cables.

b) Trouble-shooting per trouble-shooting chart of the SIS microcard, if no faults were indicated by self-diagnosis. Direct elimination of fault in the functional paths per trouble-shooting chart using individual test cables.
A test-adapter test cable is not avaiable for 35-pin control units.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments
concerning the contents to our
authorized representative in your country.

COMBUSTION NOISE FROM
PASSENGER-CAR DIESEL ENGINES

Motor vehicle: passenger car
05.1987

"START, IDLE, AND DRIVING DIESEL KNOCK"

0010 En

1. PROCESS

There has recently been an increased incidence of purchasers of diesel passenger cars complaining about loud combustion noises (engine knock).

In such cases, the results of investigation by our specialized department of the pintle nozzles are – excluding a small number of exceptions – that the nozzles (and nozzle holders) are OK per test specification, i.e. there are no functional or manufacturing defects.

The "diesel knock" complaint has to do with a noise specific to diesel engines, which is caused by combustion, and which increases under certain conditions.

2. CAUSE OF NOISE

After initial operation of the vehicle or after installation of new nozzles, there is a successive build-up of coke residues (reduction in cross-section of the throttle gap). This changes the injection process. The time span between start of injection of the nozzle and start of combustion (ignition of the air-fuel mixture in the engine) increases.

As this delay period – known as ignition lag – gets longer, more and more fuel enters the combustion chamber before combustion begins, resulting in more and more sudden combustion.

Coking is also determined by the design of the combustion chamber. Robert Bosch has only little influence here, however. The nozzles are tested intensively by the engine manufacturers and are released for each particular engine.

3. TYPES OF NOISE

3.1 Knocking during starting due to large ignition lag. Only occurs until the engine is warm, particularly at low external temperatures. Disappears after 2 – 3 minutes.

3.2 Knocking during driving
Occurs under part load in the lower and upper engine-speed ranges. Unfavorable rate-of-discharge curve promoted by heavy coking. Particularly pronounced during acceleration following a lengthy period at idle.
Does not disappear, even when the engine is warm.

3.3 Rough idling
Occurs in new vehicles or after installation of new injection nozzles.
Disappears in most cases once the vehicle has travelled 500...1000 km.

4. POSSIBLE INFLUENCING VARIABLES

4.1 Fuel
Even though the fuel manufacturers regard our experience skeptically, we observe again and again how vehicles which have taken on fuel at various locations behave very differently with regard to combustion noise. This may occur, for example, due to diesel oil with high-boiling components forming residues to an increased extent and/or when the ignition performance (cetane number = C.N.) of the fuel is lower than the demands which the engine places on the ignition performance of the fuel.

4.2 Operating conditions

4.2.1 Urban traffic
Vehicles which are predominantly used in urban traffic (part-load operation) are more frequently the object of complaint since the engines more rarely reach the necessary operating temperature (approx. 80 °C water temperature). Due to the longer periods of operation in idle (stop and go), the injection nozzles became heavily coked. They are then less intensively flushed by the injected fuel.

The problem here is caused by soft combustion residues, which under certain circumstances may be released again when driving under full load (e.g. expressway).

This applies in particular in winter and to countries where the average annual temperature is relatively low.

4.2.2 Long-distance travel (expressway)
Continous high temperatures promote the disposition of hard combustion residues which can no longer be dissolved.

4.3 Assembly
When installing the injection nozzle in the nozzle holder and the nozzle-and-holder assembly in the engine, the prescribed tightening torque must be observed and the thermal protection washer replaced in all cases. Pay attention to centrical fit.

As you know, the acoustically unpleasant engine noise can be eliminated or reduced for a short time by cleaning or replacing the injection nozzles, but this does not constitute a permanent improvement.

Numerous misunderstandings can be traced back to unawareness of the above-mentioned details and interrelationships, i.e. complaints are made and injection nozzles are rejected without justification.

Published by: ROBERT BOSCH GMBH/ Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorised representative in your country.

ELECTRONIC DIESEL CONTROL SYSTEM

Motor vehicle: Passenger car
06.1987

(without injected fuel quantity control)
DB vehicles, US version

0005 En

The electronic diesel control system comprises the following functions:

* Low-idle-speed control (ELR)

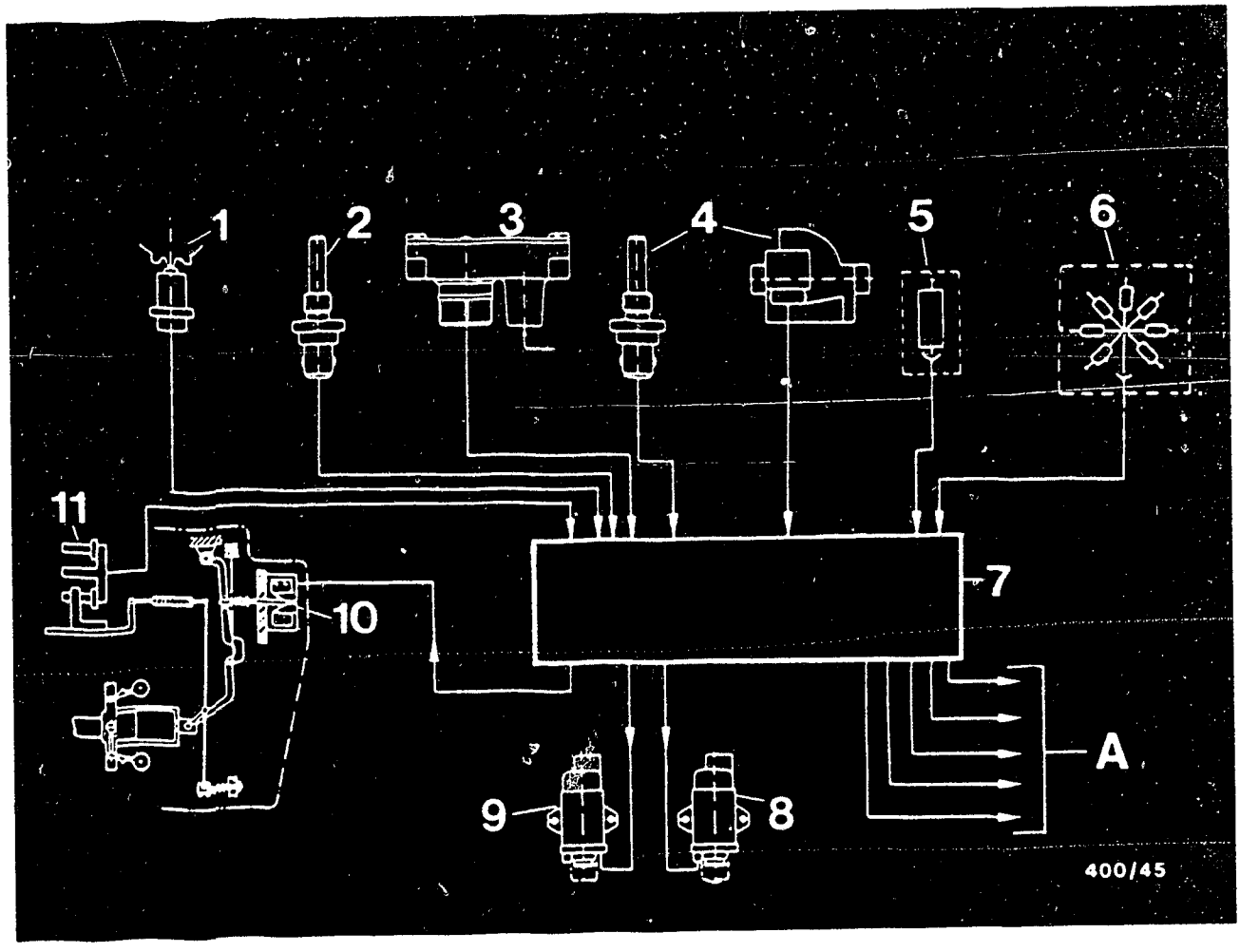
* Exhaust-gas-recirculation control (EGR)

* Bypass-air control for soot burn-off filter (only for California version)

* System diagnosis

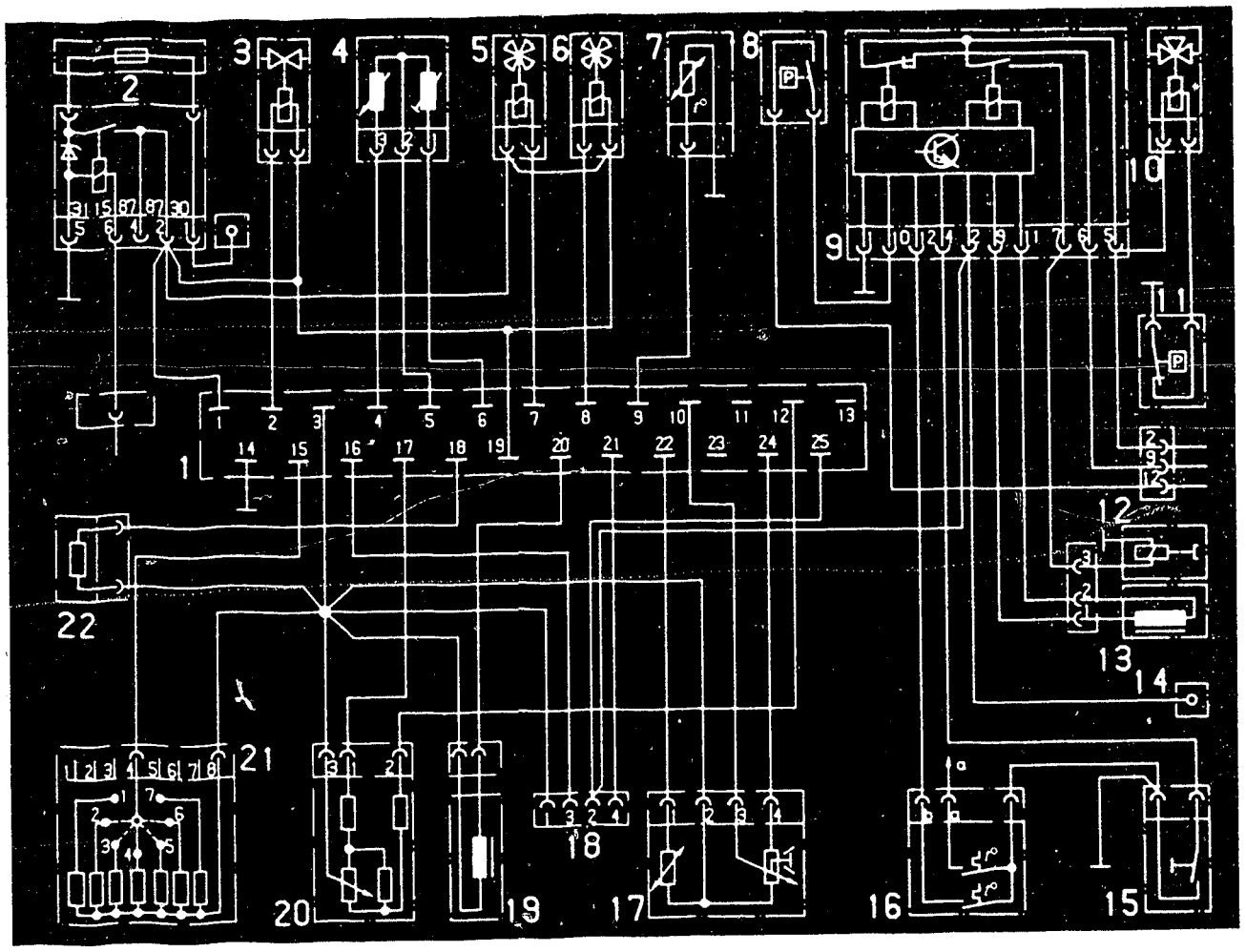
* No regulation of quantity of injection

* Daimler-Benz system designation: EDS 2



Components of electronic exhaust-gas recirculation (EGR):

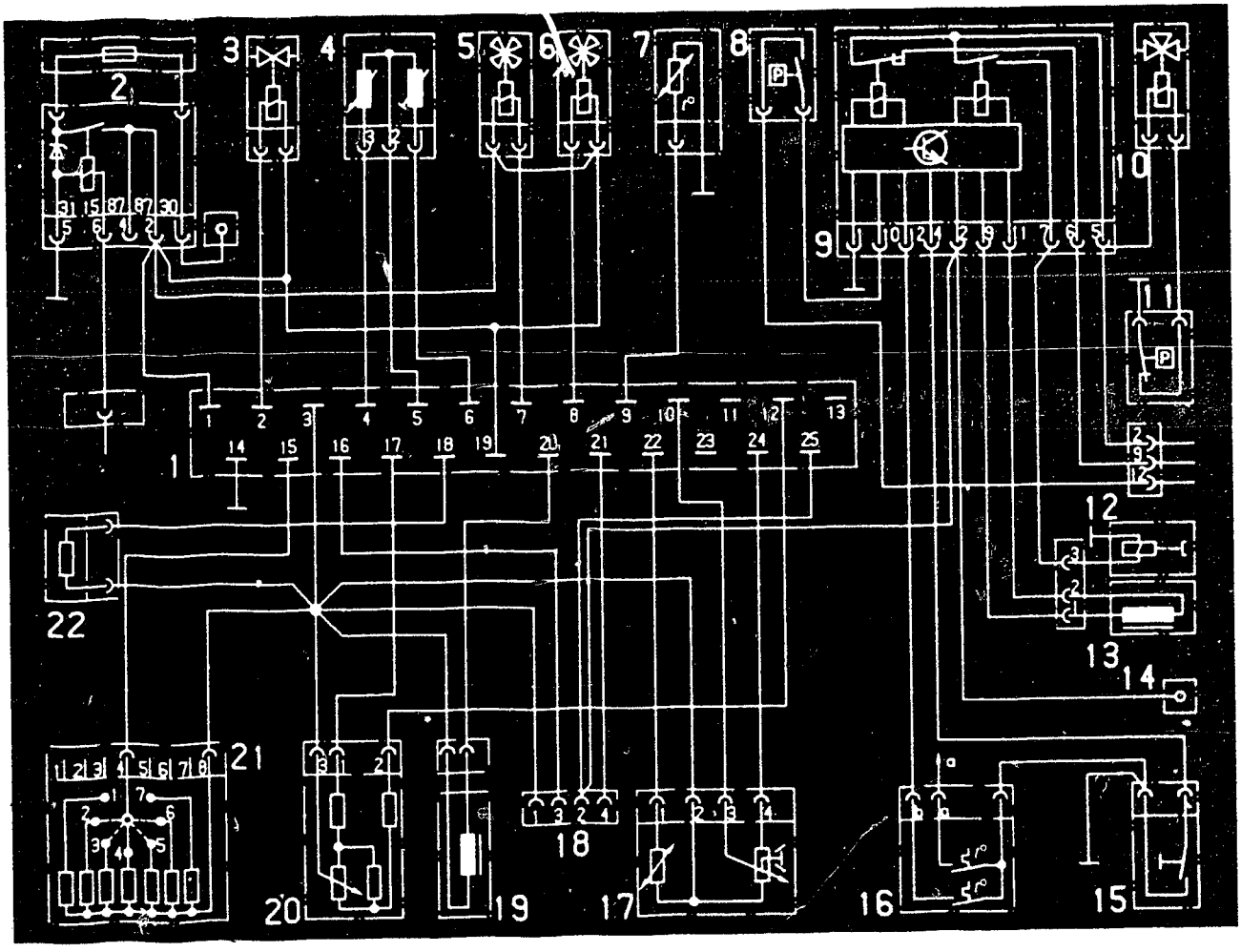
1 = Engine-speed sensor
2 = Temperature sensor (coolant)
3 = Atmospheric-pressure sensor
4 = Air-flow sensor with temperature sensor (intake air)
5 = Adjustment plug for exhuast-gas recirculation
6 = Adjustment plug for idle speed
7 = Control unit
8 = Electropneumatic pressure transducer for bypass-air control
9 = Electropneumatic pressure transducer for EGR valve
10 = Actuating solenoid for idle speed
11 = Control-rod travel sensor
A = Measurement outputs



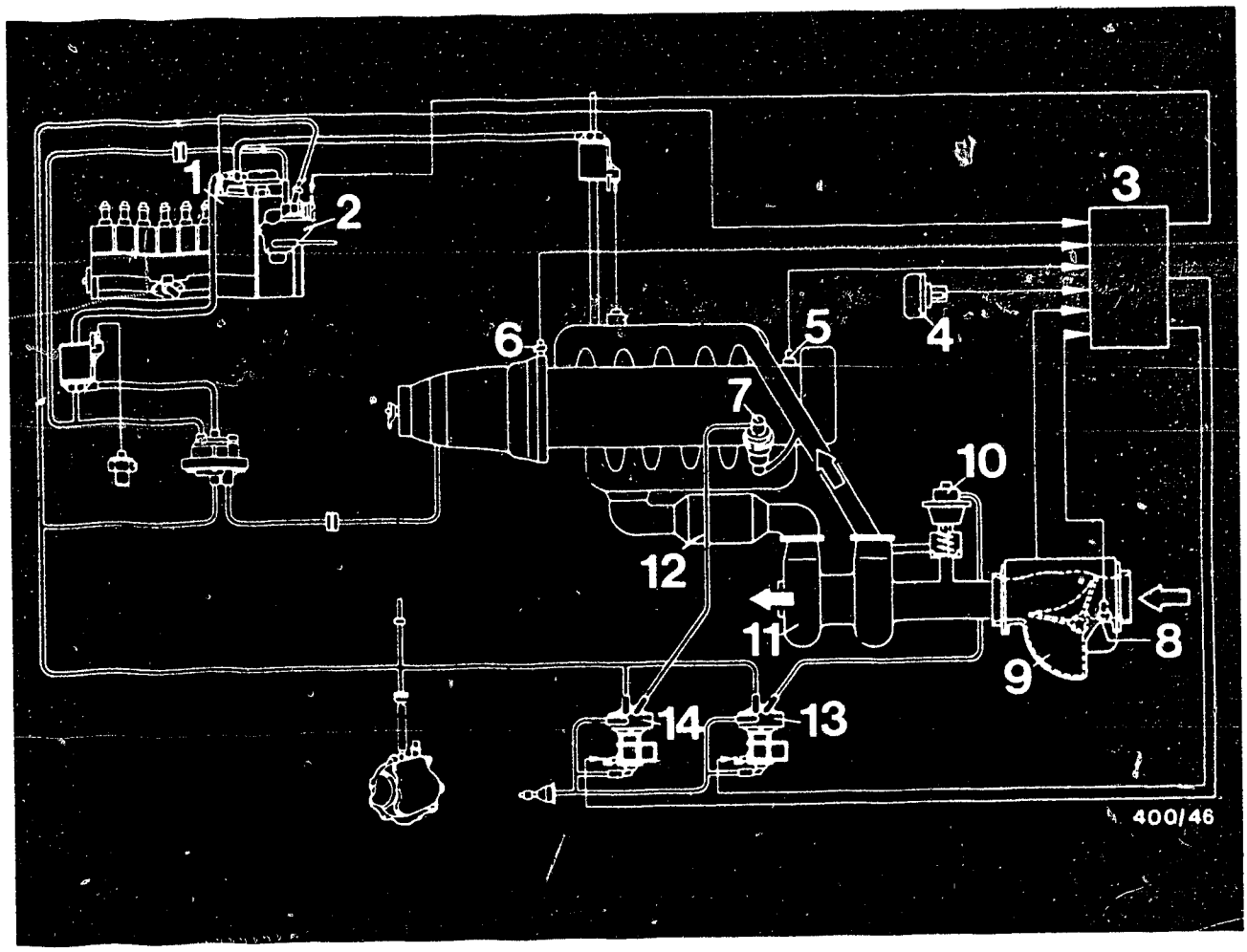
ELECTRICAL TERMINAL DIAGRAM

(Type 126 California version)

1 = Control unit
2 = Over-voltage protection
3 = Actuating solenoid "ELR"
4 = Control-rod-travel sensor
5 = Pressure transducer "EGR"
6 = Pressure transducer for bypass-air valve
7 = Temperature sensor (coolant)
8 = Pressure switch, a/c compressor
9 = Control unit for compressor shutoff
10 = Change-over valve for engine overload protecion
11 = Switch for engine overload protection



12 = Electromagnetic coupling, a/c compressor
13 = Engine-speed sensor
14 = Test connection for engine-speed signal
15 = Microswitch for compressor shutoff
16 = Temperature switch, 105...120° C
17 = Pickup, air-flow sensor
18 = Test connection for EDS system
19 = Engine-speed sensor, starting motor
20 = Atmospheric-pressure sensor
21 = Adjustment plug, idle
22 = Adjustment plug, EGR



Electropneumatic circuit diagram
1 = Control-rod-travel sensor
2 = Actuating solenoid (idle speed)
3 = Control unit
4 = Atmospher-pressure sensor
5 = Temperature sensor (coolant)
6 = Engine-speed sensor
7 = EGR valve
8 = Temperature sensor (intake air)
9 = Air-flow sensor
10 = Bypass-air valve (only on type 126)
11 = Exhuast-gas turbo-supercharger
12 = Soot burn-off filter (California version)
13 = Electropneumatic press. transd. for bypass-air contr.
14 = Electropneumatic pressure transducer for EGR valve

The electronic diesel control system is divided into three essential system blocks:

* Sensors

(e.g. engine-speed sensor, temperature sensor, air-flow sensor)

The sensors determine the operating conditions and convert the physical quantities into electrical signals.

* Control unit

The control unit processes the information provided by the sensors according to a certain logic, and produces electrical output signals.

* Actuators

The actuators (electropneumatic pressure transducers and down-stream pneumatic diaphragm actuators) convert the electrical output signals from the control unit into mechanical quantities.

Method of operation of sensors

The engine speed and control-rod position of the fuel-injection pump are determined by inductive sensors, and the rate of air flow by potentiometers.
Resistance sensors measure pressure and temperature.

Method of operation of the control unit

The control unit contains two closed digital control loops and one open control loop:

* Electronic low-idle-speed (closed loop) control (ELR)

* Exhaust-gas-recirculation (closed-loop) control (EGR)

* Bypass-air (open-loop) control for soot burn-off filter (only for California version).

The nominal values for fresh-air quantity, bypass-air control, and idle speed are calculated, using characteristic maps, from the input values of the sensors (engine speed, air temperature, air flow, control-rod position, atmospheric pressure, and coolant temperature).

By inputting the appropriate actual values (engine speed, air flow), the microprocessor program carries out a set-point/actual-value comparison and actuates the electro-pneumatic transducers (EGR valve, bypass-air valve) and the ELR actuating solenoid, using current pulses of differing lengths.

This changes the rate of exhaust-gas recirculation, the charge-air pressure, and the idle speed.

Method of operation of system self-diagnosis

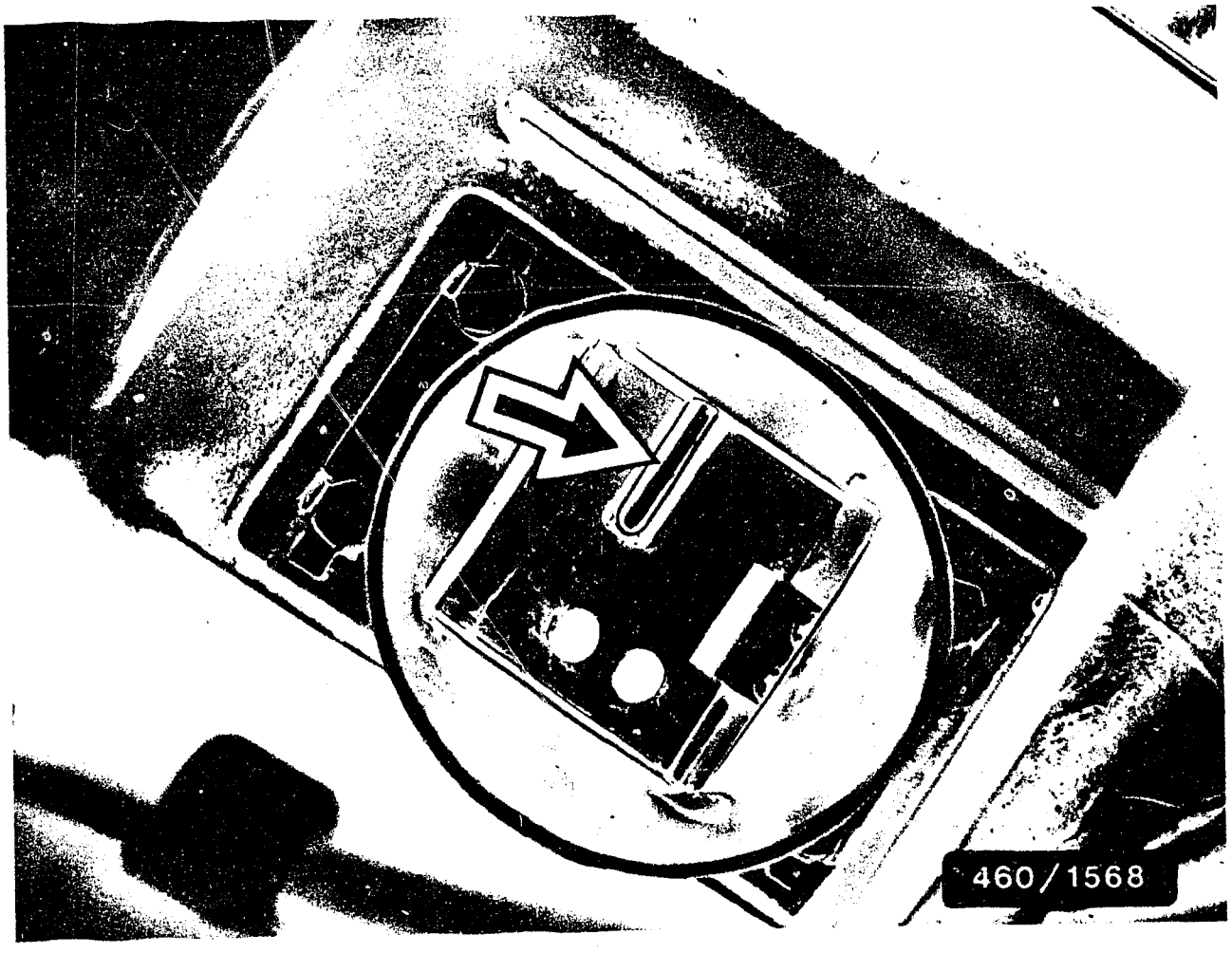
In order to make it easier to recognize faults, the control unit is equipped with self-diagnosis.

In case of system faults, after activating the diagnostics, pulses are output depending on the cause of the trouble.

These pulses can be read with the help of an LED (not installed in the vehicle).

Examples of possible diagnostic displays:

Defect	Display
Control-rod-travel sensor	2 pulses
Pickup, air-flow sensor	3 pulses
Temperature sensor (coolant)	8 pulses



Arrow = Temperature sensor (intake air)

Components of the exhaust-gas recirculation and their functions

* Air-flow sensor

The intake air deflects the sensor flap against the constant return pressure of a spring to a defined angle.

This sensor-flap position is measured by a potentiometer and converted into a voltage value.

The air-flow sensor incorporates a temperature sensor to correct for temperature-dependent air density.

* Atmospheric-pressure sensor

Depending on the altitude, an altitude correction of the amount of exhaust gas recirculated is carried out using a sensor.

The sensor supplies the control unit with a voltage signal which decreases with decreasing air pressure (increasing altitude).

By correcting the air-quantity setpoint, or nominal, value, the control unit adapts the amount of exhaust gas recirculated to the air pressure obtaining at that time.

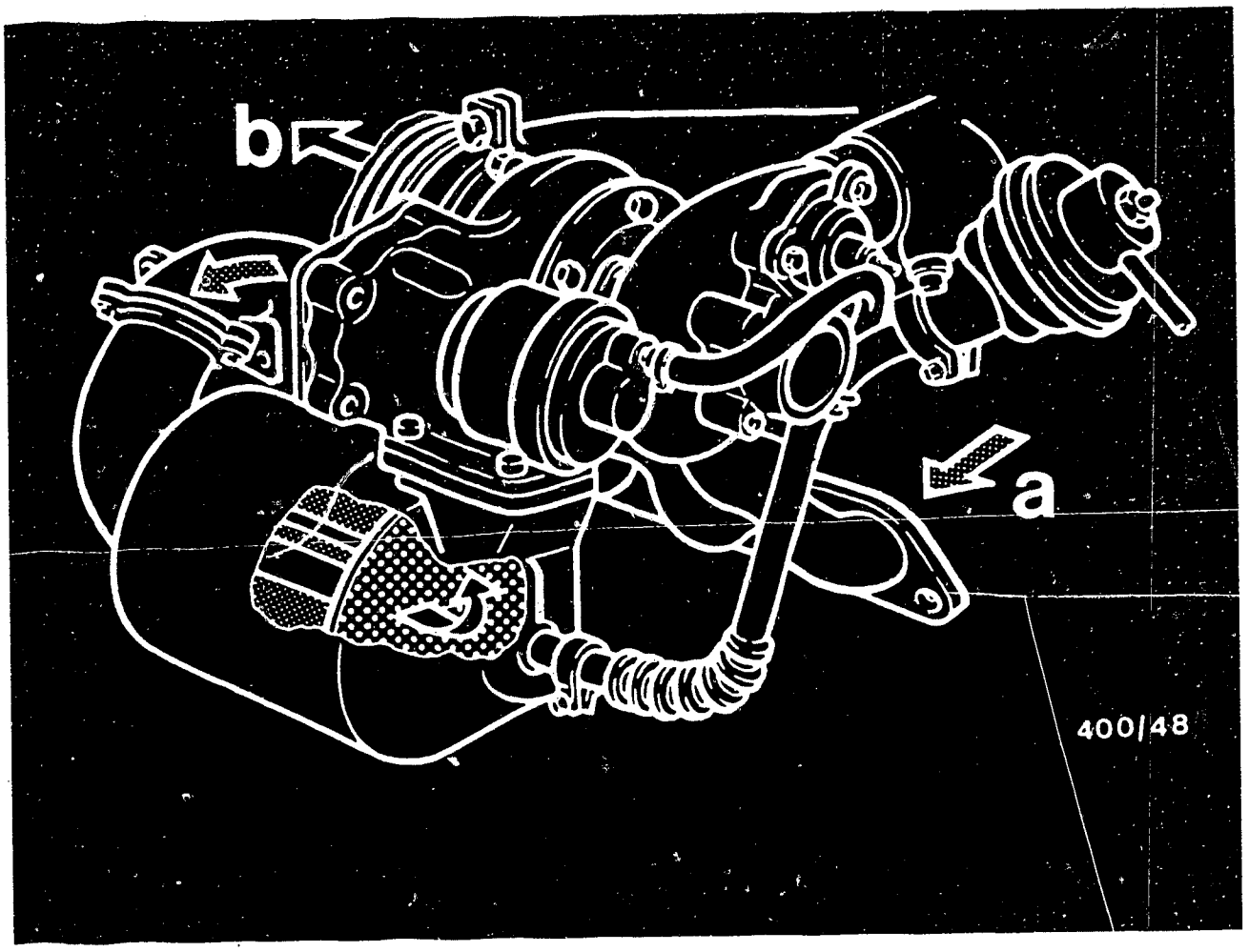
* Soot burn-off filter

The soot burn-off filter is a self-regenerating filter positioned before the exhaust-gas turbo-supercharger.

IMPORTANT

N o a d d i t i v e s which would cause ash-forming residues in combustion may be added to diesel fuel intended for vehicles incorporating a soot burn-off filter (California version).

These residues clog the soot burn-off filter and lead to severe losses in power.



a = Exhaust gas containing soot b = Cleaned exhaust gas

Regeneration depends on:

- Exhaust-gas temperature
- Oxygen content of the exhaust gases
- Load condition of the engine
- Flow-through speed
- Operating duration

The burn-off process starts at 360° C.

The filter is completely regenerated when subjected to exhaust-gas temperatures of greater than 580°C for extended periods.

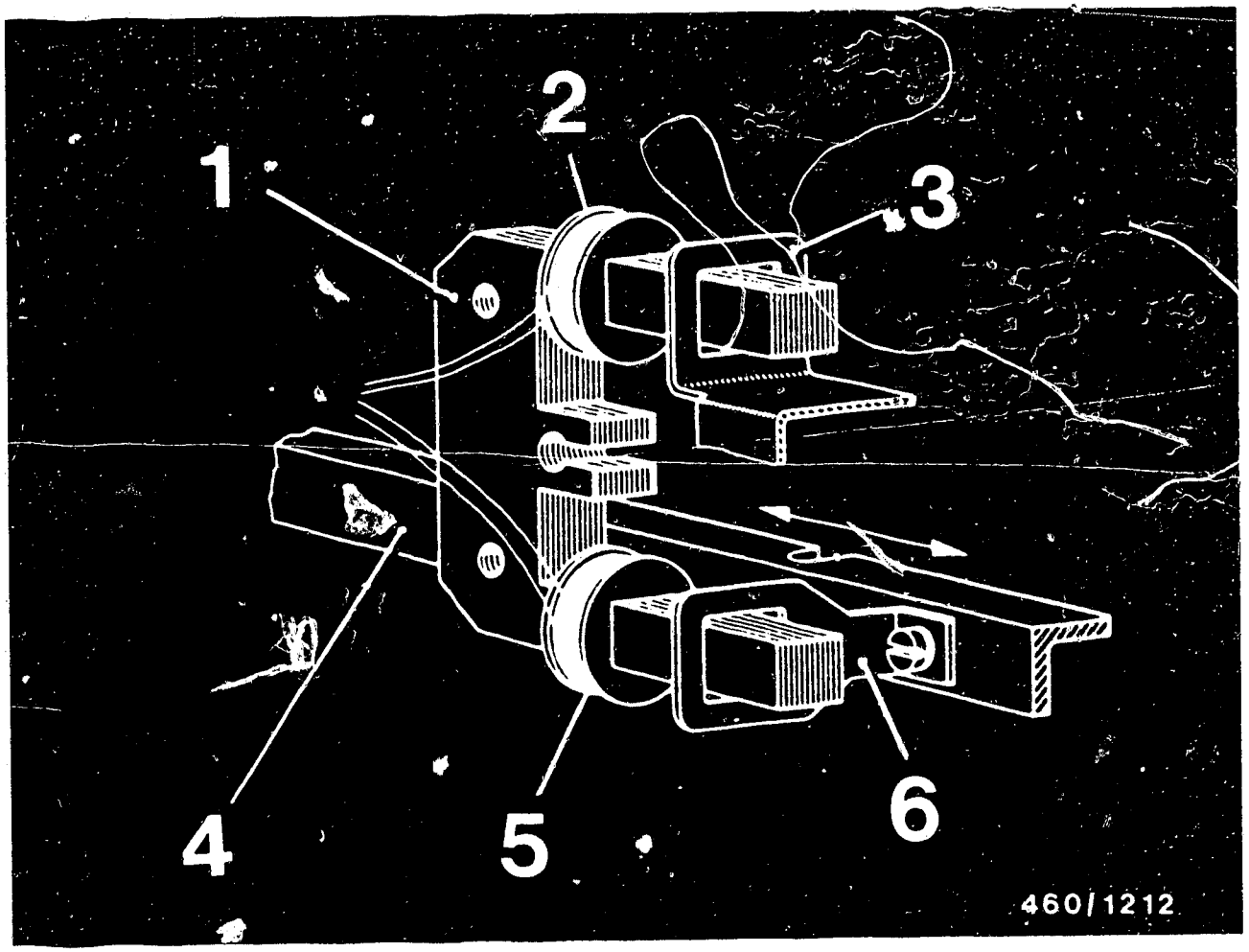
When soot is combusted in the filter, the end product consists almost entirely of CO_2 (carbon dioxide).

In order to provide burn-off conditions for the soot burn-off filter, the bypass-air valve is open or closed in accordance with a specified characteristic map.

The bypass-air valve is opened when the following conditions exist:

- Engine speed between 1000 min^{-1} and 3400 min^{-1}

- Control-rod travel less than 9.5 mm.



1 = Laminated iron core
2 = Reference coil
3 = Fixed short-circuiting ring
4 = Control rod
5 = Measuring coil
6 = Moving short-circuiting ring

Control-rod-travel sensor

The reference coil (2) and the fixed short-circuiting ring (3) form a reference inductance.
Depending on the position of the control rod (4), the distance between the moving short-circuiting ring (6) and the measuring coil (5) changes.

The resulting change in inductance is measured, and used by the control unit to derive a control-unit-travel (load) signal.

Method of operation of exhaust-gas recirculation

Exhaust-gas recirculation is used to reduce emissions of oxides of nitrogen.

The amount of exhaust gas recirculated is indirectly regulated in a closed control loop through the determination of the fresh-air quantitiy as a function of engine loading and speed.

The working range of the EGR lies in idle and in the part-load range, since the excess air may be reduced only in these ranges.

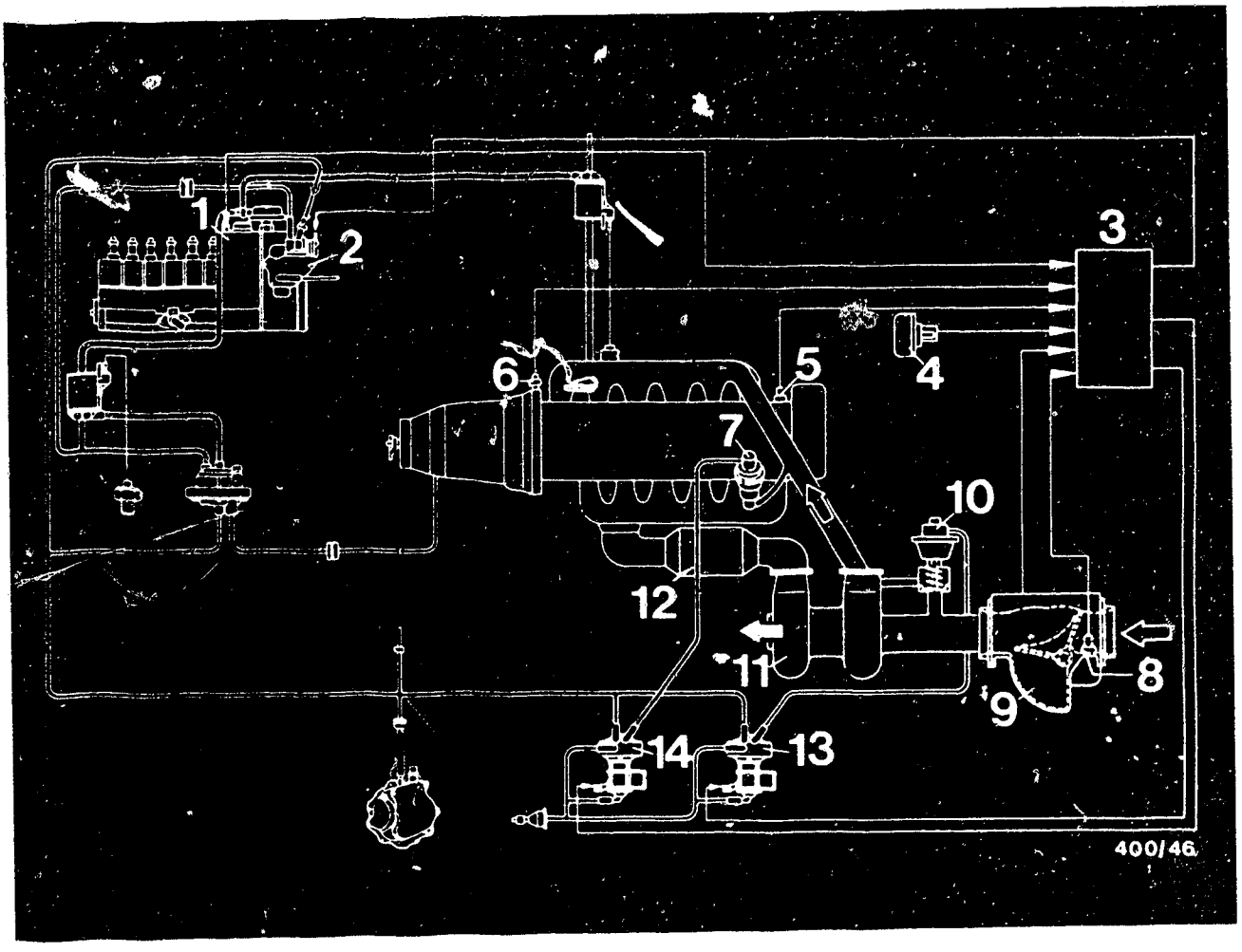
In the full-laod range and when the engine is cold, no exhaust gases are recirculated, since exhaust-gas recirculation would lead to higher concentrations of hydrocarbons (HC) and solids (soot). These pollutants are themselves subject to legal restrictions.

Operation of exhaust-gas recirculation

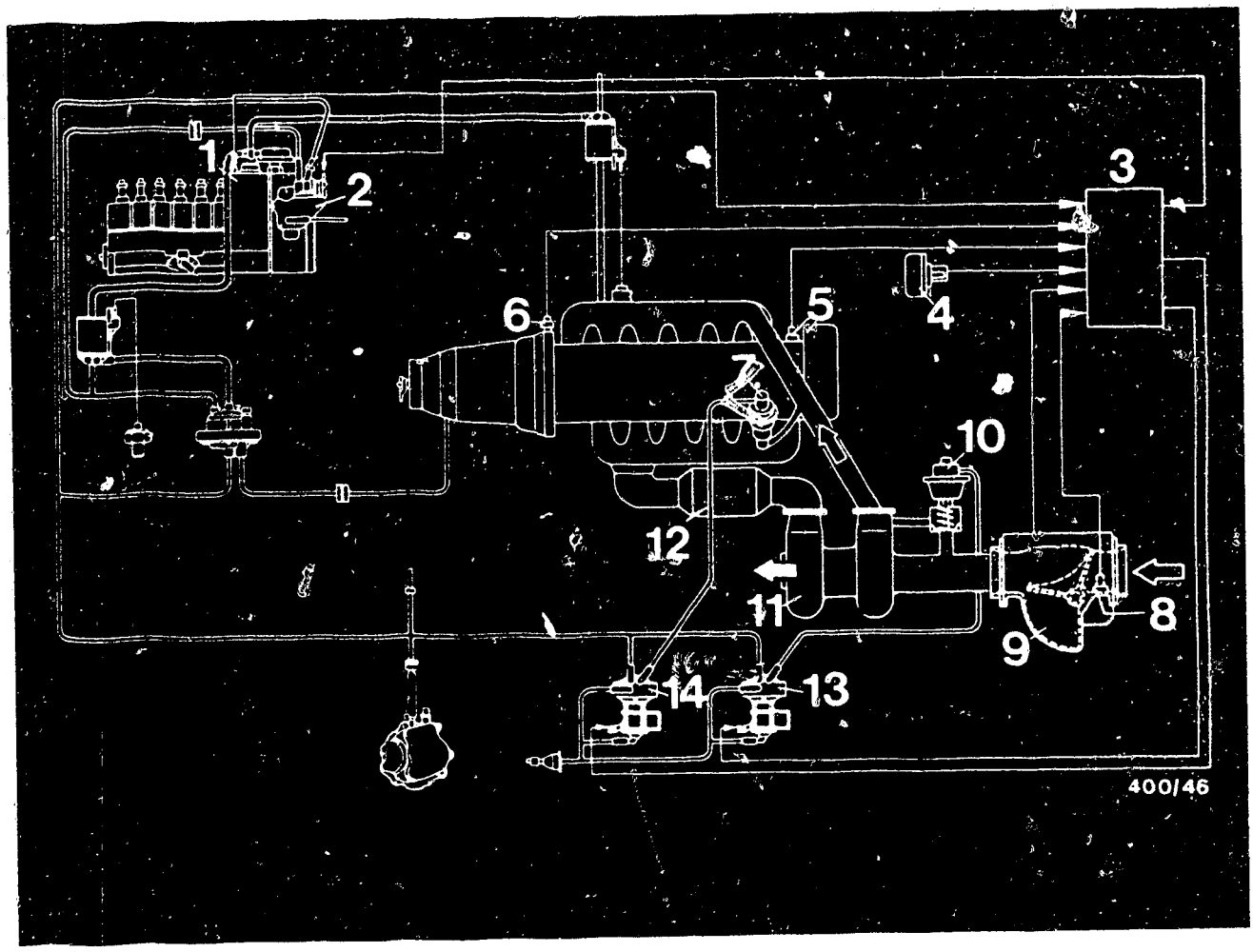
Exhaust-gas recirculation is initiated when the following conditions exist:

- Coolant temperature 30... 105° C
- Control-rod travel less than 9 mm
- Engine speed between 800 min^{-1} and 3600 min^{-1}
- Battery voltage at least 8 V

For each operating condition, the control unit determines the suitable fresh-air or exhaust-gas-recirculation quantity using the input signals (e.g. engine speed, control-rod-travel signal) provided by the sensors.



The vacuum generated by the vacuum pump is converted by the pressure transducer (14) into a vacuum signal. This signal is used to actuate the exhaust-gas-recirculation valve (7).
The pressure transducer is actuated in turn by the EGR regulator (built into the control unit) depending on the closed-loop control deviation (nominal – actual air quantity) until the nominal and actual air quantities are in agreement.



Depending on the load condition of the engine, in vehicles made for California, vacuum is applied to a bypass-air valve (10) in the part-load range via an electropneumatic pressure transducer (13).
This causes a reduction in the charge-air pressure.
The rate of air flow is reduced and the exhaust temperature increased at a given injection quantity.
This improves the conditions for regeneration of the soot burn-off filter.
The electropneumatic pressure transducer is actuated by the control unit using the processed input signals.

Responsible:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments
concerning the contents to our authorized
representative in your country.

O-RING FOR K-JETRONIC FUEL-INJECTION VALVES 0 437 502 ..

Motor vehicle: Passenger cars
05.1987

0006 En

The O-ring for K-Jetronic fuel-injection valves with O-ring sealing is available as a replacement part under part no. 3 430 210 604 (replacement for 3 430 210 600). This O-ring is also listed on the replacement-part microcard EE..* together with other Jetronic replacement parts.

* See microcard EE 00 under 0 280

Since these O-rings are subjected to extreme temperature stress, they should always be changed when servicing.

"Secondary air", which is inducted through poorly-sealed fuel-injection valves, is a frequent cause for servicing.

Responsible:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

BMW has introduced a n e w generation of Motronic control units in the 7-series as of 6.86 and in the 6-series as of 10.86 (5- and 3-series to follow).

N E W

These control units must be programmed by KH for the specific vehicle type b e f o r e delivery to the BG/BD.

N o t e :
The vehicle will not run with an uncoded control unit.
Incorrectly-coded control units can result in engine damage.

In addition to the 10-digit part number, KH requires the following information for coding:

(1) = Part number, 10-digit
new (2) = Growth number, 3-digit (001 to 999)
new (3) = Variant control word, alpha-numeric, 4-digit

Example: (1) = 0 261 200 150
(2) = 002
(3) = 005E
(See also illustrations on following pages)

I M P O R T A N T !

When ordering a control unit, the growth no. (2) and variant control word (3) must be specified in a d d i t i o n.

Without this information, the control unit cannot be programmed.

Control-unit types

0 261 200 150, old version, FD 645-651
0 261 200 150, new version, as of FD 652

0 261 200 151
0 261 200 152
0 261 200 153
0 261 200 154

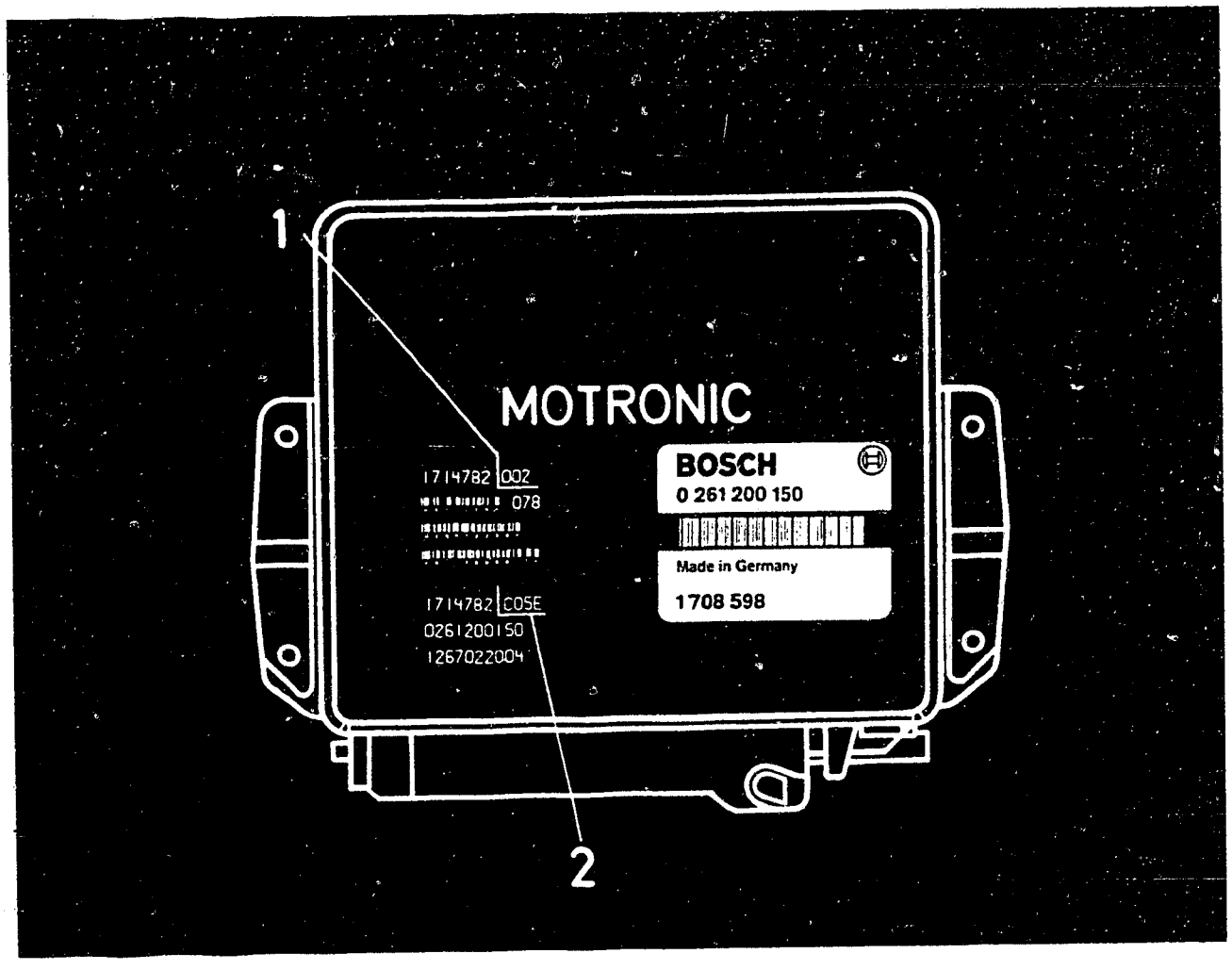
Delivery

- The variant-coded control units are handled as central stock parts at KH.
- Delivery via overnight mail (within Germany) direct to the ordering party.
- Due to the necessity for programming the control units at KH, delivery is delayed by one day.

Responsible:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

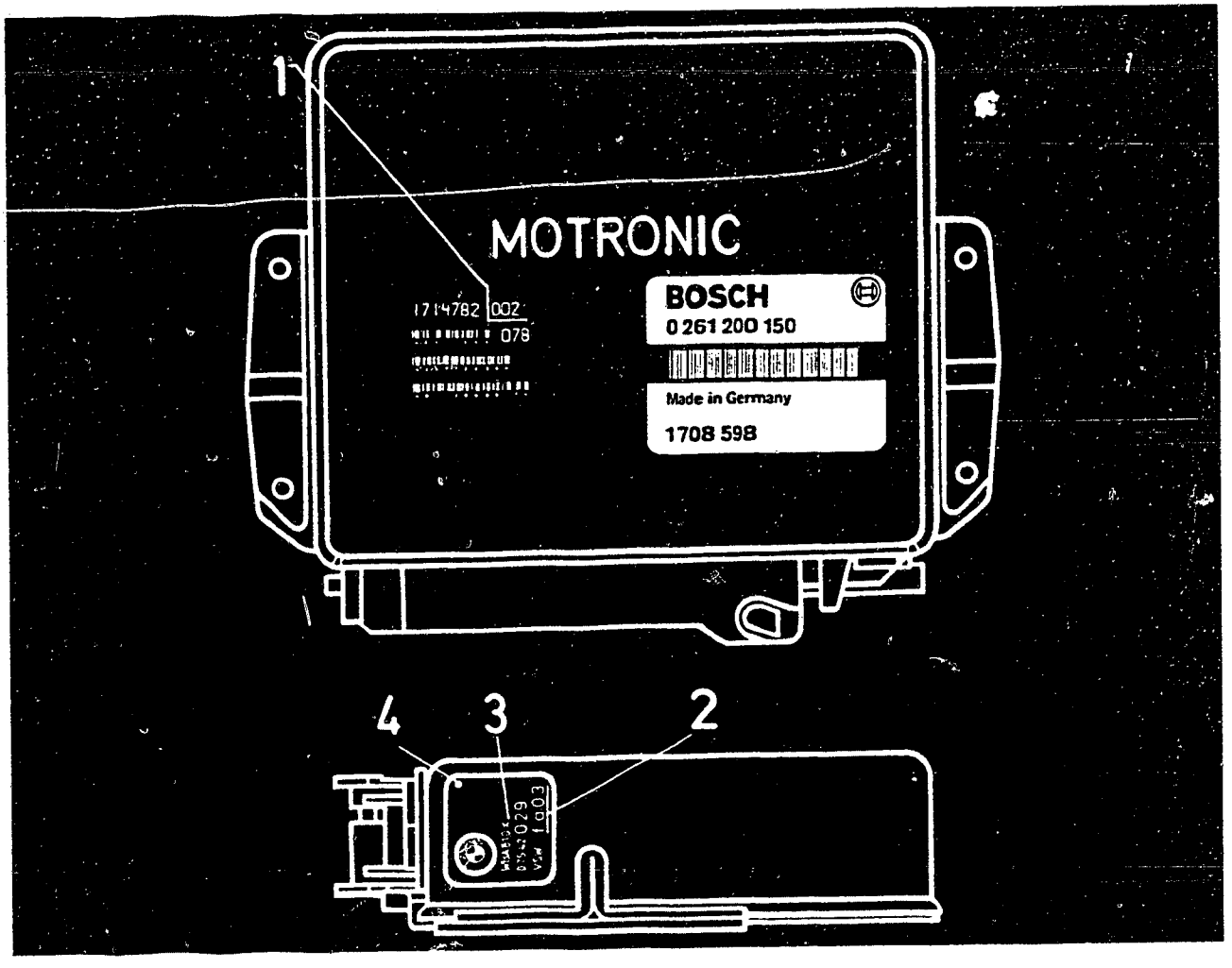
Please direct questions and comments concerning the contents to our authorized representative in your country.



1 = 3-digit growth no.
2 = Variant control word (code),
alpha-numeric, 4-digit

Motronic mit variant coding

Control unit (0 261 200 150 only), old version,
FD 645-651.



1 = 3-digit growth no.
2 = Variant control word (code)
alpha-numeric, 4-digit
3 = Chassis no.
4 = BMW sticker

Motronic with variant coding

Control units of new version, as of FD 652.

BMW 324 d with
DISTRIBUTOR-TYPE FUEL-INJECTION PUMP
0 460 406 047 (R 206)
Complaint of "constant bucking during driving"

Motor vehicle: Passenger car
05.1987
0012 En

If a complaint of "constant bucking during driving" occurs with the above vehicle, an improvement can be made by installing flat-type pintle nozzle

0 434 250 148 (DN 0 SD 286)

instead of the flat-type pintle nozzle 0 434 250 117 (DN 0 SD 259) installed as standard equipment up until FD (date of manufacture) 741.

The nozzle-opening pressure of nozzle 0 434 250 148 should be set to 130 + 8 bar. After conversion, mark the nozzle holder with a spot of white paint on the holder.

Starting with FD 742, the new nozzle is installed as standard equipment in the nozzle-and-holder assembly 0 432 217 180.

Always exchange the nozzles in sets. This work is not to be free of charge.

Responsible:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

FIAT Croma td with DIST.-TYPE FUEL-INJECTION PUMP 0 460 404 040 (R 192) up to FD 744
Engine shake at idle

Motor vehicle: PASS. CAR
08.1987
replaces 05.1987

If complaints about "engine shake at idle" arise with regard to the vehicle mentioned above, the driveability of the vehicle may be improved by installing delivery-valve assemblies >> 1 468 532 257 << in place of the delivery-valve assemblies 1 468 532 233 installed as standard up to FD 744 (April 1987).

Replacement of the delivery-valve assemblies must be carried out set by set with the pump installed.
When the delivery-valve assemblies are exchanged, gaskets 1 460 105 305, Item 54 in the service-parts list, must also be replaced and the delivery-valve holders must be tightened to a tightening torque of 38..42 Nm.

After the conversion, the delivery-valve holder of the distributor-type fuel-injection pump must be marked with a white dot.

As of FD 745 (May 1987), the delivery-valve assemblies 1 468 532 257 will be installed as standard.

This work must be carried out for the customer without charge during the warranty period.

Any costs for materials which arise for the delivery-valve assemblies and gaskets will be reimbursed along the usual lines for Bosch warranty claims. Please report fault number 20 making written reference to this Service Information document.
Labor costs for 10 WUs (1 hour) are reimbursed by any Fiat dealership. This has been arranged in conjunction with Fiat/Turin and all Fiat dealerships have been informed of this by way of a Fiat workshop bulletin.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

LANCIA Thema td with DIST.-TYPE FUEL-INJECTION PUMP 0 460 404 040 (R 192) up to FD 743
Engine shake at idle

Motor vehicle: PASS. CAR
08.1987
0014 En

If complaints about "engine shake at idle" arise with regard to the vehicle mentioned above, the driveability of the vehicle may be improved by installing delivery-valve assemblies >> 1 468 532 257 << in place of the delivery-valve assemblies 1 468 532 233 installed as standard up to FD 744 (April 1987).

Replacement of the delivery-valve assemblies must be carried out set by set with the pump installed.
When the delivery-valve assemblies are exchanged, gaskets 1 460 105 305, Item 54 in the service-parts list, must also be replaced and the delivery-valve holders must be tightened to a tightening torque of 38..42 Nm.

After the conversion, the delivery-valve holder of the distributor-type fuel-injection pump must be marked with a white dot.

As of FD 745 (May 1987), the delivery-valve assemblies 1 468 532 257 will be installed as standard.

This work must be carried out for the customer without charge during the warranty period.

Any costs for materials which arise for the delivery-valve assemblies and gaskets will be reimbursed along the usual lines for Bosch warranty claims. Please report fault number 20 making written reference to this Service Information document.
Labor costs for 10 WUs (1 hour) are reimbursed by any Fiat dealership. This has been arranged in conjunction with Fiat/Turin and all Fiat dealerships have been informed of this by way of a Fiat workshop bulletin.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Brief Description of System

The electronic transmission control system calculates the optimum gear of the automatic transmission depending upon the instantaneous operating condition of the vehicle.

In cooperation with manufacturers of vehicles and transmissions, BOSCH has developed the electronic control.

Users

As the first vehicle manufacturer to do so, BMW is equipping its 7, 6, 5, and 3 Series vehicles with the electronic transmission control system as an optional extra.

Components

Pressure regulator	= integrated in the automatic transmission *
Solenoid-operated valves	= integrated in the automatic transmission *
Control unit	0 260 002 .. (BOSCH)

Detailed equipment data are listed in the respective vehicle-equipment microcard AP.. .

* Non-BOSCH product
After-sales service only from transmission manufacturer

Service/exchange parts

See Exchange Microcard WB 01 and Exchange Price List PD 02 for exchange parts.

Test concept (electronics only)

Testing of the system in the vehicle is performed using the universal test adapter in conjunction with a special adapter lead as well as a commercially available multimeter.
Special tools are not necessary.
Mechanical testing of the transmission must be performed only by the vehicle and/or transmission manufacturer.

Testers:

Universal test adapter ETT 018.01 Part No. 0 684 101 801

Adapter lead GS, self-sufficient
(also on loan from BG or RG/AV) Part No. 1 684 463 161

Delivery in the usual way (technical equipment supplier BG, RG/AV).

Technical documentation

Trouble-shooting instructions and test specifications:
SIS Microcard PKW.. (see Overview microcards KFZ 00..

System training:

Integrated in the specialist "Motronic" course.

Retrofitting:

This system is not designed for retrofitting purposes.

Warranty handling:

a) Germany

During the warranty period, components under complaint must be sent for warranty assessment to the respective BG:

K1 / VAK 2
Robert Bosch-Straße
D-7141 Schwieberdingen

with warranty claim application G 20
and delivery note KH/VKD 3 - 15 333

b) Remaining countries

During the warrant period, components under complaint must be sent for warranty assessment to our authorized representative in your country.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

MERCEDES-BENZ Type C 126, 380 SEC, 420 SEC, 500 SEC, 560 SEC as of 1981 — Motor vehicle: PASS. CAR 07.1987

Testing the seat-belt feeder

0017 En

The test concept schedules the use of the heater and air-conditioner test adapter KDHK 0001 in conjunction with a special system cable for testing the seat-belt feeder 0 132 004 0.. in the vehicle.

Due to the relatively low profile of the seat-belt feeder on the market, the system cable is for the time being not available for purchase.

If required, KH/VSK2 in Wernau or KH/VKD2 in Karlsruhe will provide a system cable on loan if requested either over the phone or in writing by the Bosch After-Sales-Service Organization.

Heater and air-conditioning test adapters are available on loan from BG.

For appropriate SIS microcard, see KFZ 00..

For description of the seat-belt feeder, see microcard PKW 038, Coordinate J 28.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales-Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

BMW 524 td WITH DISTRIBUTOR-TYPE FUEL-INJECTION PUMP 0 460 406 022 (R 121) Motor vehicle: PASS. CAR 07.1987

1. Complaints about "constant bucking when driving"
2. Replacement of the fitting, complete (Item 58) 0021 En

If complaints about "constant bucking when driving" arise with regard to the vehicle mentioned above, the driveability of the vehicle may be improved by installing the flat-type pintle nozzle
0 434 250 148 (DN 0 SD 286)
in place of the flat-type pintle nozzle 0 434 250 117 (DN 0 SD 259) installed as standard.

The nozzle-opening pressure for nozzle 0 434 250 148 must be set to 150 + 8 bar. After the conversion, the holder of the nozzle-holder assembly must be marked with a yellow dot. The new nozzle is already installed in the nozzle-and-holder assembly 0 432 217 184. Replacement of the nozzles must be carried out set by set. Work must be charged to the customer.

2. As of FD 745 fittings (Item 58) 1 463 370 326 and ..379 used until now will be replaced by 1 463 370 380. Installation of old and new on one distributor-type fuel-injection pump is not possible, this meaning that if replacement is necessary, all 6 fittings must be replaced by the 1 463 370 380 version. The tightening torque is 45...55 Nm.

Published by:

ROBERT BOSCH GMBH
Divison KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

DRUM BRAKE

Register tab 8 PASS. CAR Brake File
identity VDT-I-PB 117 En

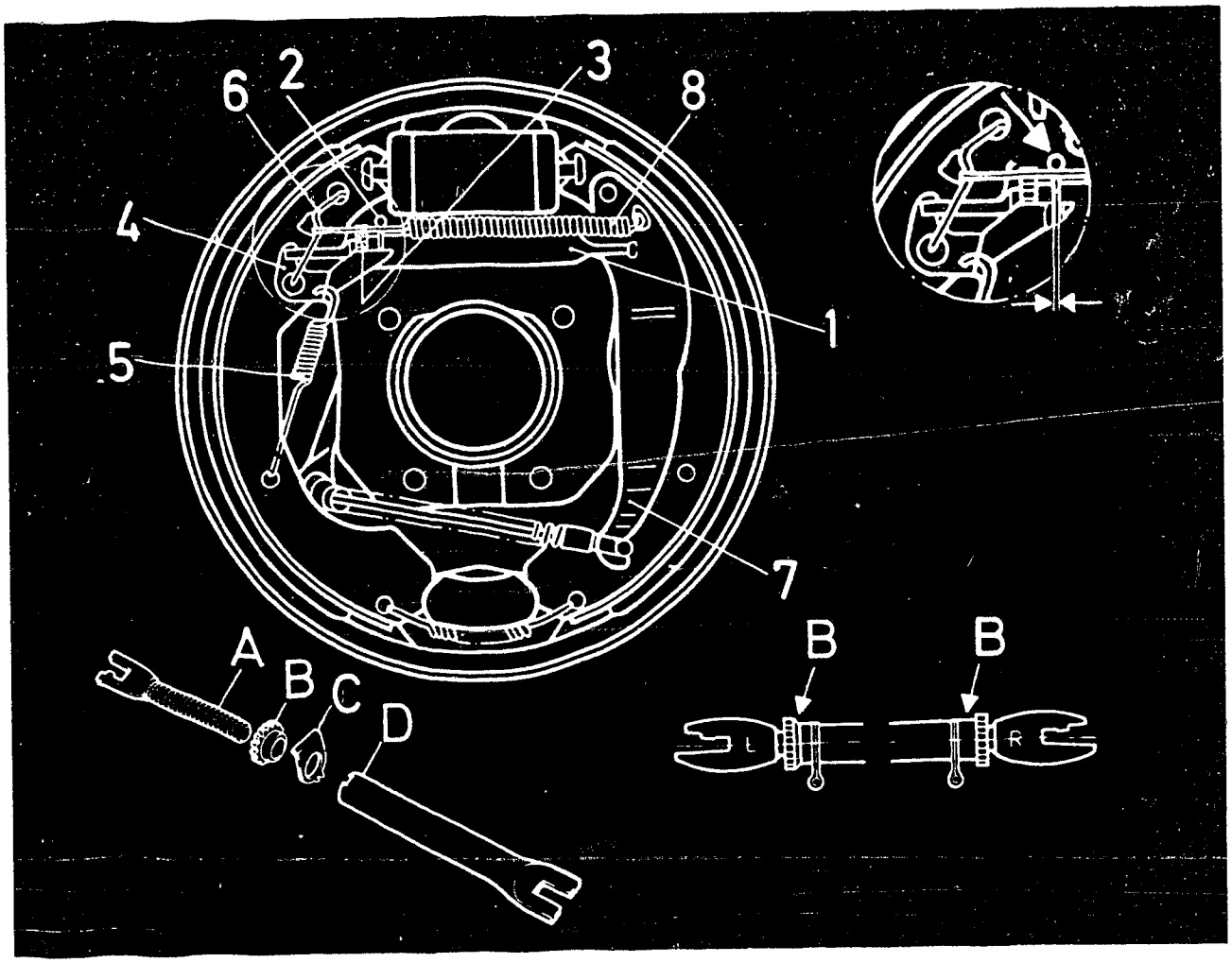
Automatic adjustment with thermoclip

The ventilation clearance is necessary in order to avoid friction (rubbing) between the brake linings and the brake drum when the brake is not actuated. This must be guaranteed also with automatic adjustment. The basic ventilation clearance is set as a feature of the design by the number of teeth on the adjustment pinion.

Long periods of braking generate temperatures of approximately 350°C in the brake drum, which lead to an increase in the diameter of the brake drum.

Automatic adjustment without thermoclip would mistakenly understand this as "wear information" and would adjust the position of the brake linings towards the heated-up and enlarged brake drum. On cooling down, this would lead to the wheels locking.

The thermoclip (thermal overload protection) has the job of preventing such adjustment. As of a certain temperature, the thermoclip expands and thus lengthens the complete adjustment unit.



Structure

1 = Adjustment unit
2 = Thermoclip
3 = Adjustment pinion
4 = Adjustment lever
5 = Extension spring
6 = Holder for return spring
7 = Hand-brake-shoes lever
8 = Return spring

ADJUSTMENT UNIT

The adjustment unit (1) of the rear-wheel brake, which comprises pressure rod (A), pressure-rod sleeve (D), adjustment pinion (B) and thermoclip (C), is positioned between the primary shoes and the hand-brake-shoes lever (7).

The threaded rods have either a left-hand or right-hand thread and are marked with L or R in order to avoid mixing them up when installing.

Adjustment pinion (3), adjustment lever (4) and the holder for the return spring (6) are also identified via color coding in order to likewise avoid mixing them up.

The parts stated for the left-hand side are black; those for the right-hand side are silver.

The left-hand adjustment pinion can be recognized from its bevel and the right-hand adjustment pinion from its protrusion.

- When assembling, make sure that the adjustment pinion (B) has full freedom of movement over the complete thread length of the pressure rod (A).

- Likewise, make sure that the adjustment pinion (B) and the thermoclip (C) are in their correct positions. The lower securing lug of the thermoclip (C) must always be latched into the recess of the pressure-rod sleeve (D) – safeguard against twisting.

ATTENTION!
THE MANUFACTURER RECOMMENDS THE REPLACEMENT OF THE THERMOCLIP EVERY TIME THE DRUM BRAKE IS DISASSEMBLED.
USAGE:
The thermoclip is used in the following vehicles:
BMW 3 and 5 series
Opel – all except Senator/Monza; as of model year 1984.

Published by:

ROBERT BOSCH GMBH/Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

PRESSURE TESTER KDHB 0002

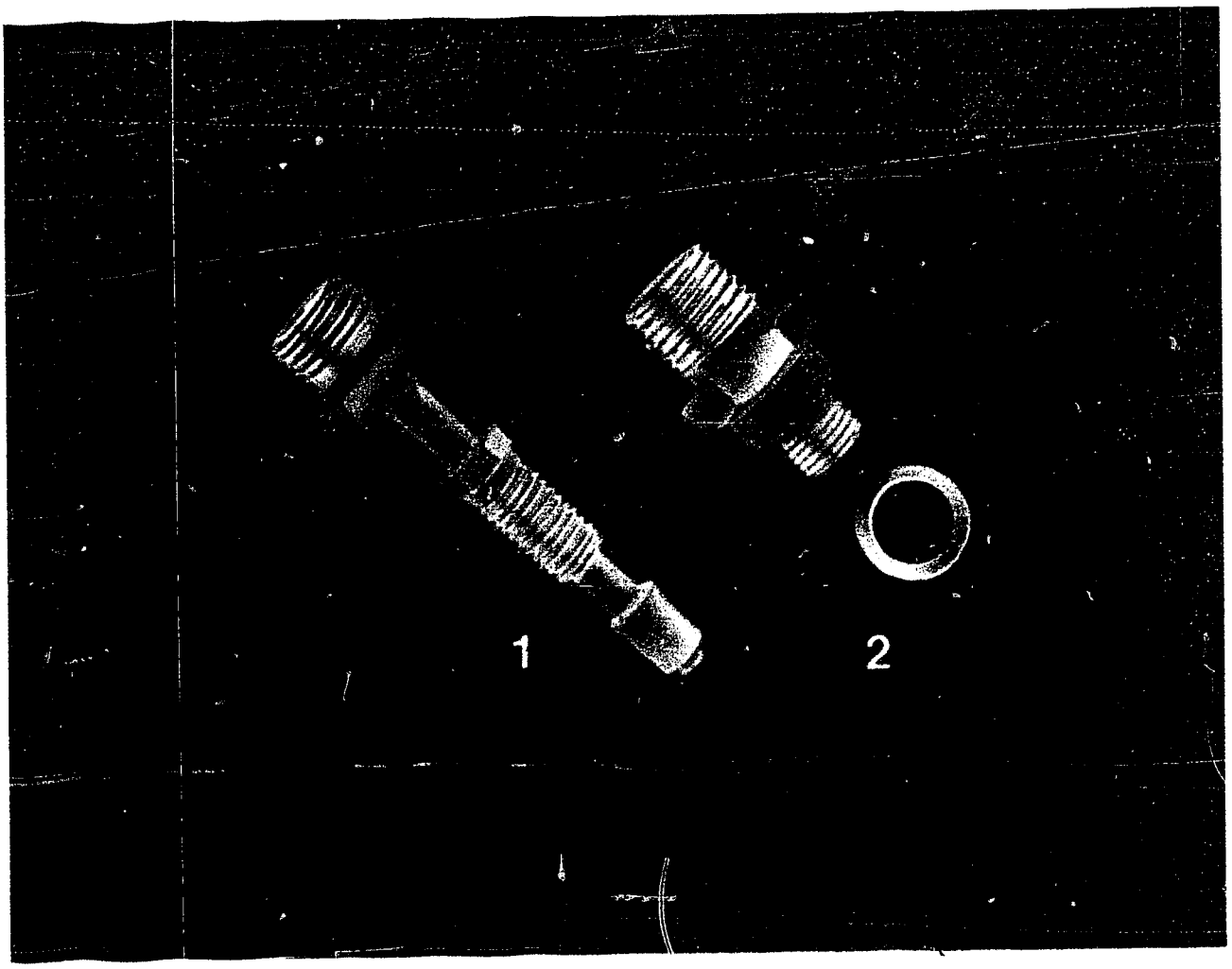
Register tab 4 PASS. CAR Brake File

Usage for Citroen BX, CX, and GSA

identity VDT-I-PB-118 En

The pressure tester for the hydraulic brake power-assist unit – KDHB 0002 / pressure range 0 – 250 bar (see illustration) – may also be used for Citroen brake systems in conjunction with the corresponding adapter pieces.

The Citreon brake system is a power-brake system. The brake pressure is thus not generated at the brake pedal, but controlled by it. Pressures of approximately 170 bar are available.



Special accessories

1 = Adapter piece KDHB 0002 / 4

2 = Adapter piece KDHB 0002 / 5
including 1 Cu seal ring 10 x 14 x 1.5
DIN 7603

To be able to make an overall assessment of the brake system, various pressure tests must be performed.

At the pressure regulator:	Cutoff pressure	165...175 bar
	Cut-in pressure	140...150 bar
	Warning switch	75....95 bar
	Brake-pressure accumulator	62 + 2 bar
		−32 bar
	Safety valve	
	– BX, GSA, CX	70....90 bar
	– CX without	110...130 bar

Without the disc-brake caliper: maximum pressure on emergency braking

The test procedures are to be taken from the Service Information documents VDT-I-PB 113/11 in adapted form.
As after-sales-service tools, the adapter pieces must be obtained from KH/VKD 3.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Supplementary-equipment sets for
conversion to low-pollution operation

3 conversion kits are available for subsequent conversion of the following vehicle models.

Conversion kit part no. 1 467 001 301 consisting of:

- timing-device cover marked with "S".
- timing-device spring

A p p l i c a t i o n :

Golf/Jetta naturally aspirated diesel with manually shifted transmission, model 8.84 up to 12.84.

Conversion kit part no. 1 467 001 302 consisting of:

- timing-device cover marked with "T".

A p p l i c a t i o n :

Golf/Jetta Turbo Diesel with manually shifted transmission, model 5.82 up to 12.84.

Conversion kit part no. 1 467 001 303 consisting of:

- timing-device cover marked with "S".

- timing-device spring

4 flat-type pintle nozzles

A p p l i c a t i o n :

Golf/Jetta naturally aspirated diesel with manually shifted transmission, model 8.80 up to 7.84.

Installation instructions for conversion kit 1 467 001 301

- Clean timing-device cover and surrounding area.
- Catch any escaping fuel.
- Take off timing-device cover.
- Remove installed timing-device spring.
- Install timing-device spring from conversion kit.
- If available, take shims out of removed timing-device cover and insert into new cover marked with "S".
- Assemble timing-device cover.
- Start engine and test timing-device cover for leakages.

Installation instructions for conversion kit 1 467 001 302

- Clean timing-device cover and surrounding area.
- Catch any escaping fuel.
- Take off timing-device cover
- If available, take shims out of removed timing-device cover and insert into new cover marked with "T".
- Start engine and test timing-device cover for leakages.

- Clean timing-device cover and surrounding area.
- Catch any escaping fuel.
- Take off timing-device cover.
- Remove installed timing-device spring.
- Measure spring-wire diameter of removed timing-device spring.

  N o t e :
  From FD 248 (August 82) to FD 249 (September 82), timing-device springs with different spring-wire diameters were installed in series production.
  FD 248 = 2.7 mm spring-wire diameter
  FD 249 = 2.8 mm spring-wire diameter

  With spring-wire diameter of 2.8 mm:

  install available shims into new timing-device cover marked with "S".

  With spring-wire diameter 2.7 mm:

  reduce available total shim thickness by 1.5 mm.
  At least one shim must be available on both sides of the timing-device spring.

- Assemble timing-device cover.
- Remove nozzle-holder assembly.
- Remove installed nozzle and install new nozzle (contained in conversion kit).
- Set opening pressure to 130 + 8 bar.
- Insert new thermal-protection washers.
- Install nozzle-holder assembly.
- Start engine and test fuel-injection system for leaks.

The following timing-device values apply when testing converted pumps

Supplementary-equipment sets: 1 467 001 301
and 1 467 001 303

1100 1/min	=	0.4...1.2 mm
1500 1/min	=	2.1...2.5 mm (setting)
2400 1/min	=	6.0...6.8 mm

Supplementary-equipment set: 1 467 001 302

1000 1/min	=	1.3...2.1 mm	0.75 bar
1500 1/min	=	3.3...3.7 mm	0.75 bar (setting)
2250 1/min	=	6.1...6.9 mm	0.75 bar

Missing test values in accordance with test specifications of the respective types of pump.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

NEW PRODUCT

Motor vehicle: PASS. CAR
08.1987

CAR ALARM SYSTEMS AA 20c 0 986 335 015/ ... 018
CAR ALARM SYSTEMS AA 20i 0 986 335 016/ ... 019

0030 En

Since the end of 1986, a new alarm system for 12 V vehicles has been available from BOSCH.

The alarm system is available with two different priming devices as desired.
* AA 20c = AA 20 with "codeable" push-button switch.
* AA 20i = AA 20 with infrared remote control.

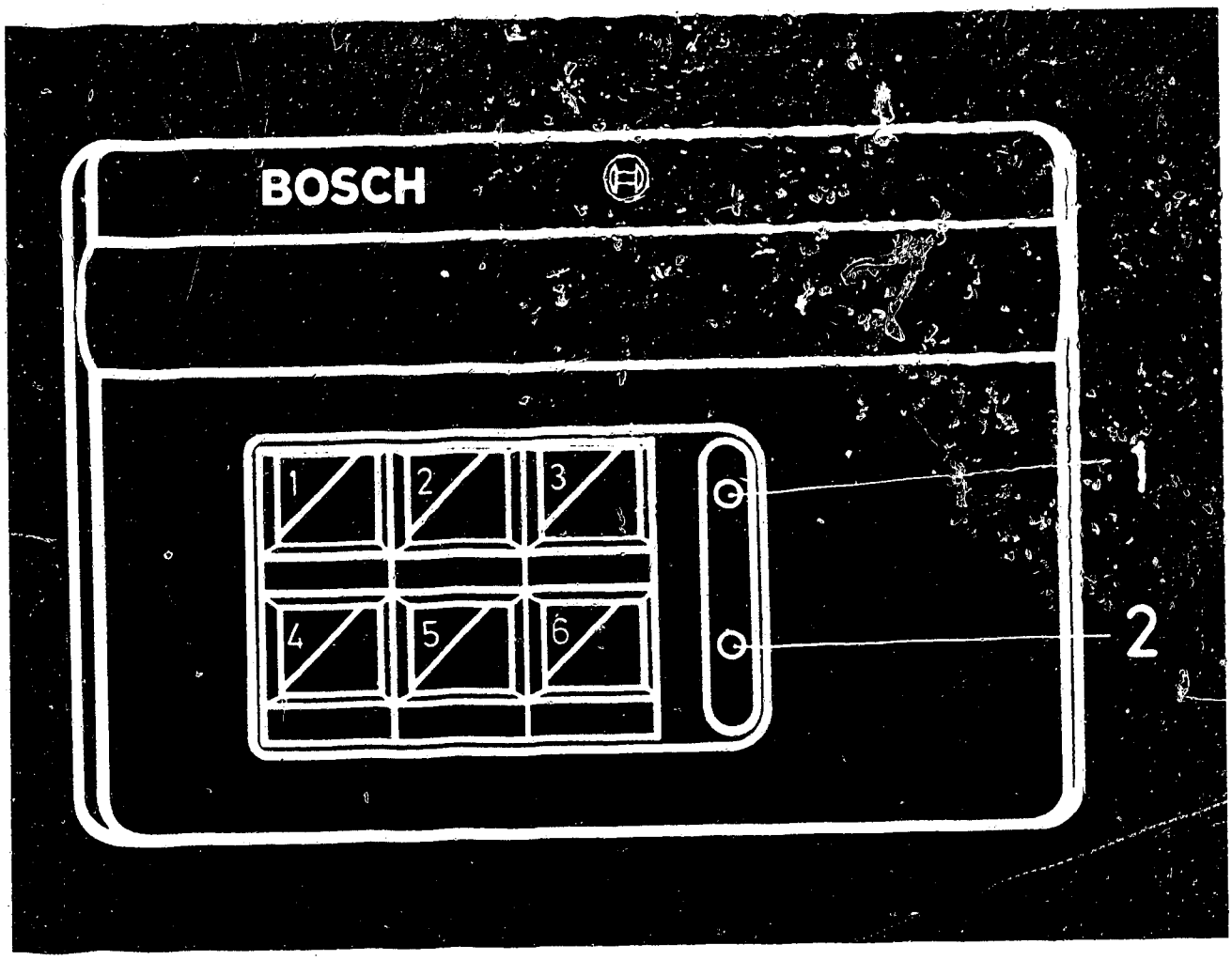
Basic alarm system AA 20

* More modern technology compared to previous alarm systems. Printed-circuit board constructed with SMD components, i.e. more functions possible using the same space.
  Size of alarm relay same as that for AA 2.

* Additional alarm output for optical alarm.
  Alarm duration max. 5 minutes.

* Priming delay and alarm delay selectable in two stages.
  Priming delay 0 or 45 seconds.
  Alarm delay 5....8 seconds or 10...14 seconds.

* Available with two priming devices:
  push-button switch with AA 20 c
  infrared remote control with AA 20 i



1 = LED indicator

2 = Code-change button

AA 20 c:

ENCODING SWITCH

* Codeable push-button switch with six push-buttons and approx. 1500 possible codes.

* The system is primed and unprimed with the push-button switch.

  Priming of the system is performed by simultaneously pushing at least one of the push-buttons in both the upper and lower rows of push-buttons. The LED indicator (1) then lights up for approx. 3 seconds.

The system is unprimed by keying in the selected four-digit personal code number.
The LED which lights up while the code is being entered goes out when the correct code is entered.

* The personal code may be changed at any time when the alarm system is unprimed. To do this, actuate the code-change push-button, enter the code number which was last applicable (LED then lights up) and then key in the new four-digit code number (LED then goes out).

* If the battery is disconnected, the code switch automtically returns to the basic code.

Infrared remote control

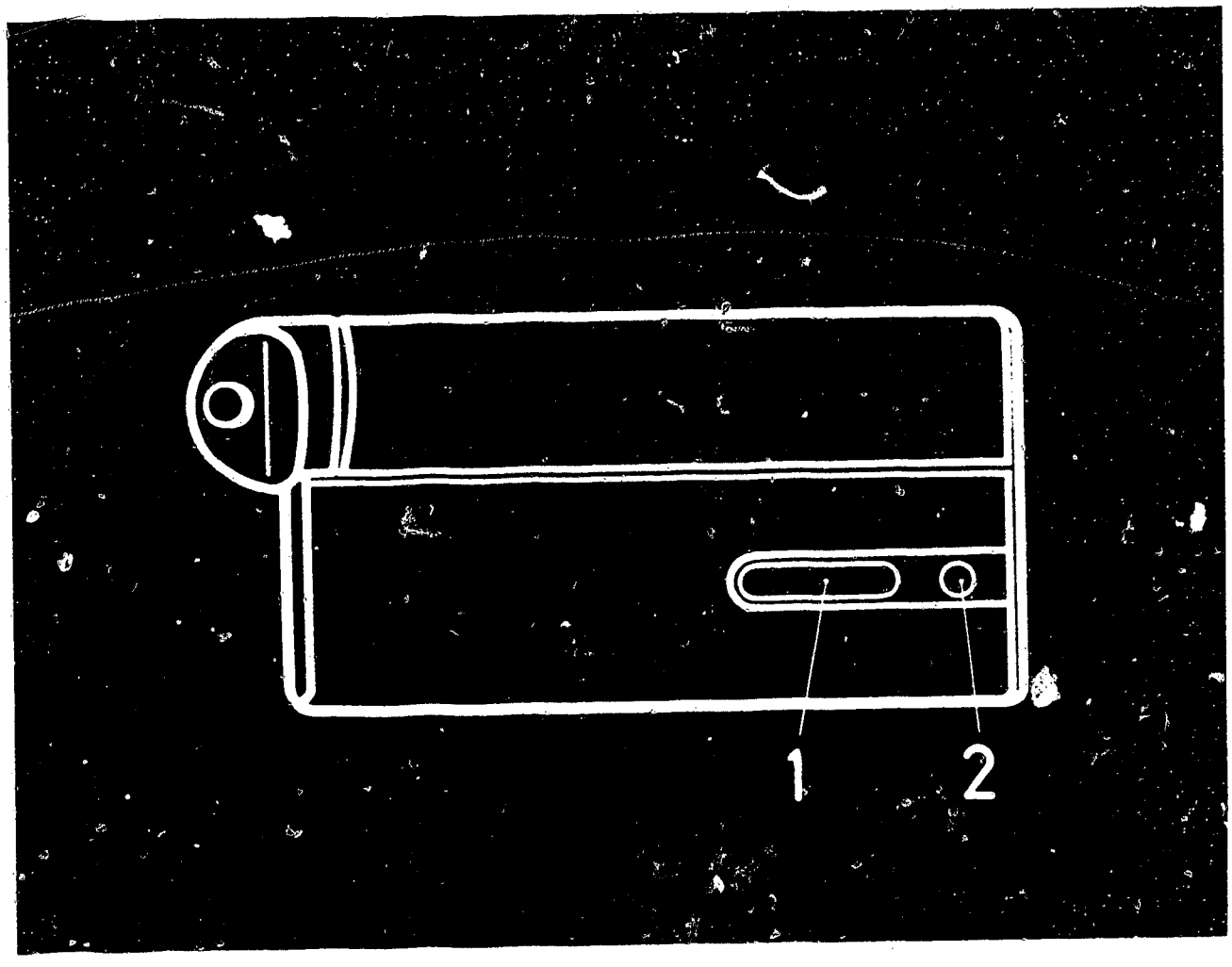
* Infrared transmitter the size of a cigarette lighter.

* Approx. 13 000 different codes programmed at the factory.

* Infrared receiver in the form of a visible eye, installed in the instrument panel.

* Priming and unpriming of the system is performed by depressing a button on the infrared transmitter. The transmitter must be aimed at the receiver in the car. Depending upon the condition of the transmitter's battery and light conditions, the range may be up to 10 m.

* Once the system is primed, the LED of the receiver flashes for approx. 3 seconds.
After unpriming, the LED remains lit for approx. 3 seconds.



1 = Transmitting button 2 = Transmitting LED indicator

A T T E N T I O N :
If the infrared transmitter is lost, a replacement transmitter may be supplied only if the correct code is stated when ordering.
For this reason, keep the safety code together with a note of the code in a safe place.

Published by:
Robert BOSCH GmbH / Division KH
After-Sales Service Department for Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

NEW SYSTEM

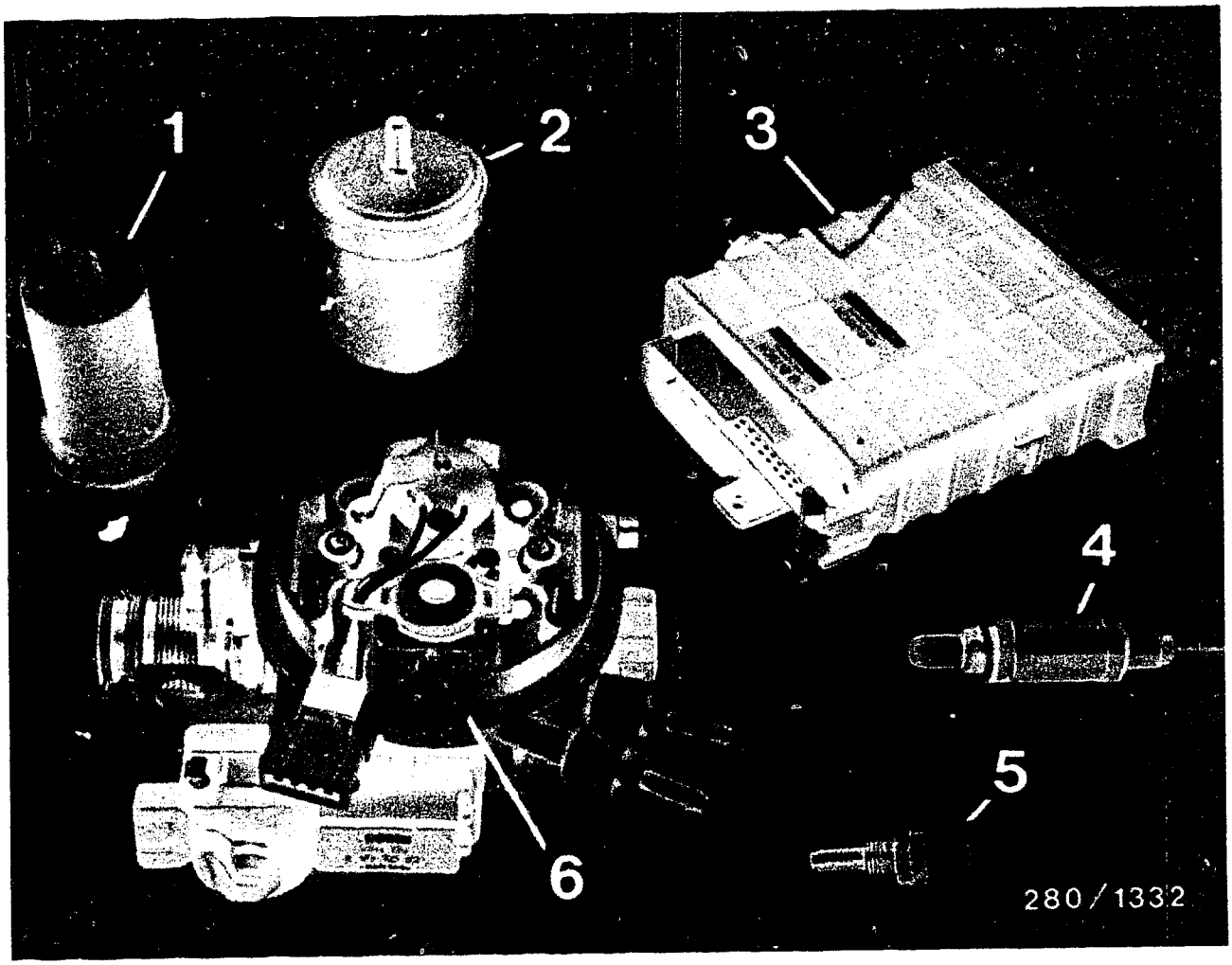
Motor vehicle: PASS. CAR
07.1987

M O N O - J E T R O N I C

Electronically controlled low-pressure gasoline-injection system without air-flow sensor

0026 En

1 = Electric fuel pump
2 = Fuel filter
3 = Control unit
4 = Lambda sensor
5 = Engine-temperature sensor
6 = Throttle-body injection unit



F e a t u r e s

The Mono-Jetronic is an alpha/n system

Alpha = Throttle-valve angle, load detection via double potentiometer.
n = Engine speed, information from the ignition system.

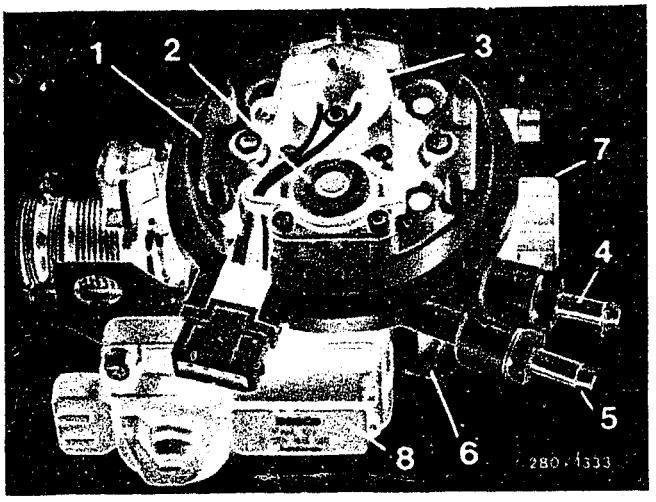
The basic duration of injection is calculated from the two pieces of information.

The core of the system is the throttle-body injection unit. It controls the intake air via the throttle valve and supplies the engine with finely atomized fuel. This fuel is injected into the inducted air above the throttle valve intermittently by o n e injection valve.

Throttle-body injection unit

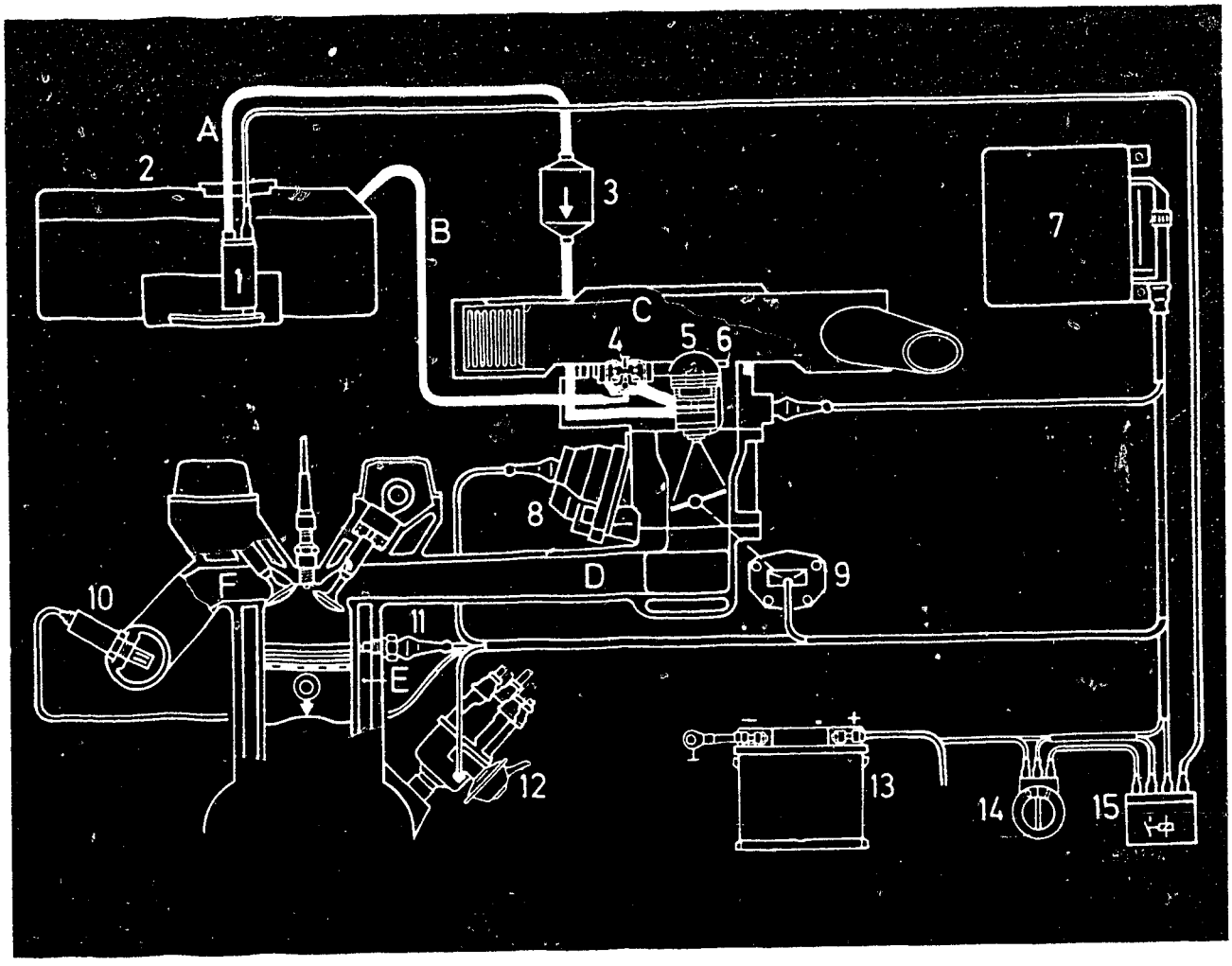
1 = Hydraulic section
2 = Pressure regulator
3 = Injection valve and temperature sensor (air)
4 = Fuel return line
5 = Fuel inlet

6 = Throttle-valve section
7 = Double potentiometer
8 = Electric idle actuator



As is the case with the L-Jetronic, the sensors detect all the essential operating variables which are required for optimum control of the injection.
The electronic control unit calculates the duration of injection and processes the activating signal for the solenoid-operated injection valve.

The exhaust-emission limits are adhered to with the aid of lambda closed-loop control and lambda sensor. Using the information from these units, it is possible to realize self-adaptation (ability to learn). Through self-adaptation, it is possible to compensate for drifts and leakage air. Thanks to the idle-speed control, lambda closed-loop control, and adaptive control-unit functions, the system is to a great extent maintenance-free.



System overview

1 = Electric fuel pump
2 = Fuel tank
3 = Fuel filter
4 = Pressure regulator
5 = Solenoid-operated injection valve (minivalve)
6 = Temperature sensor (air)
7 = Control unit
8 = Electric idle actuator
9 = Double potentiometer
10 = Lambda sensor
11 = Temperature sensor (engine)
12 = Ignition distributor
13 = Battery
14 = Ignition and starting switch
15 = Relay (main and pump relays

A = Fuel pressure
B = Return line, pressureless
C = Atmospheric pressure
D = Pressure in intake manifold
E = Coolant
F = Exhaust gas

The Mono-Jetronic can be divided into four functional areas:

- Fuel supply
- Measuring of operating data
- Lambda closed-loop control
- Control-unit function

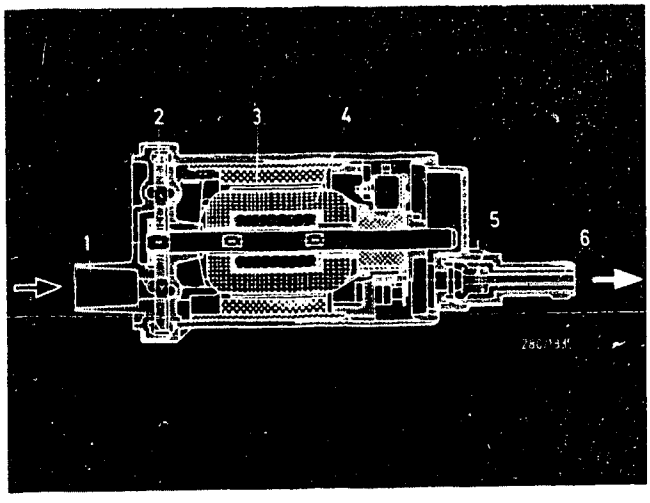
FUEL SUPPLY

Electric fuel pump

The 2-stage low-pressure flow pump is intalled in the fuel tank. The housing and impeller are made of fiber-glass-reinforced plastic. The fuel flows through the electric fuel pump and line filter with paper cartridge (average pore size: approx. 0.01 mm), and reaches the injection valve of the throttle-body injection unit.

Electric fuel pump

1 = Suction fitting
2 = Impeller with inner and outer blade ring
3 = Permanent magnet
4 = Armature
5 = Non-return valve
6 = Pressure fitting

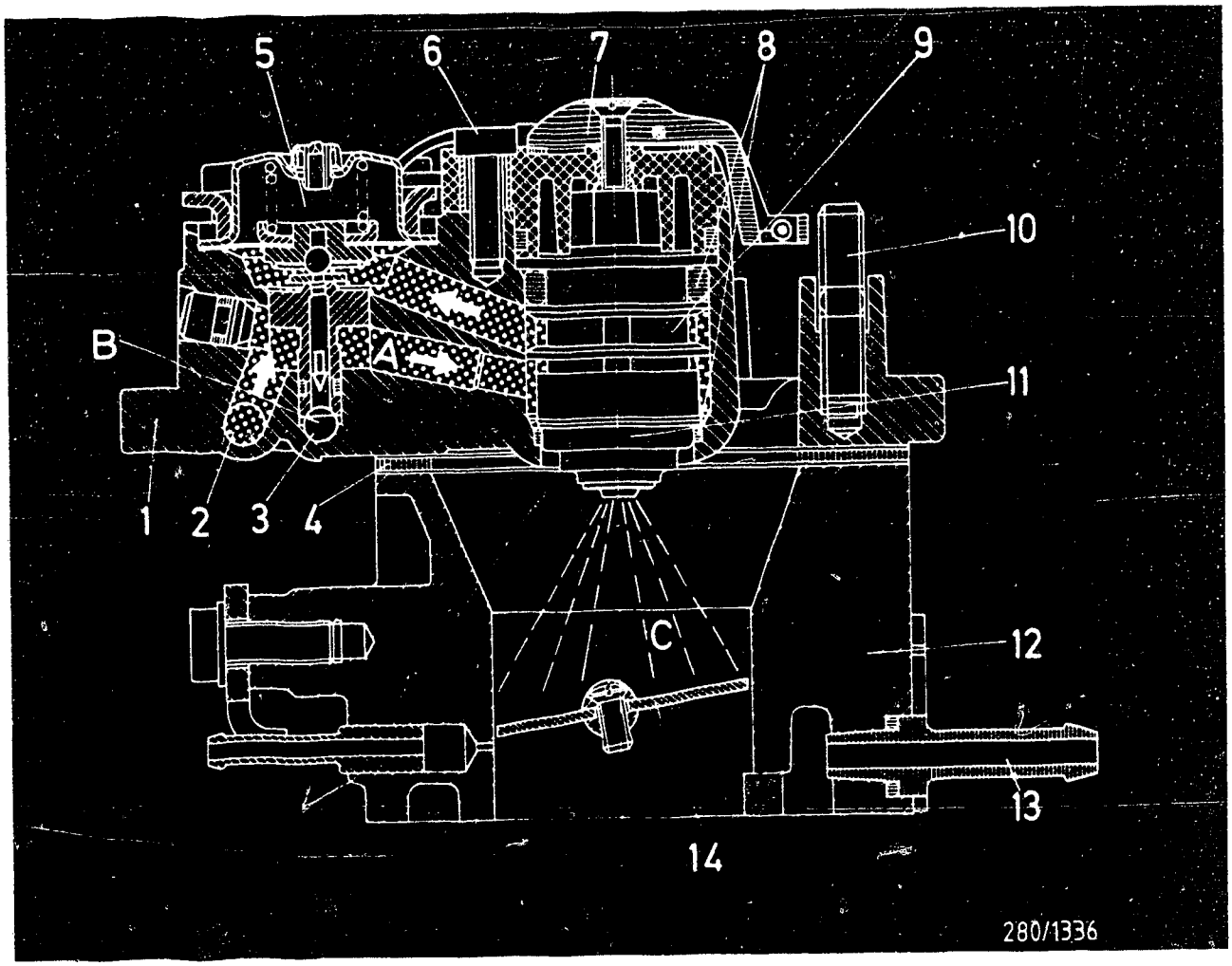


Throttle-body injection (TBI) unit

The TBI unit, mounted directly on the intake manifold, supplies all the cylinders with finely atomized fuel. It consists of the throttle-valve section and the hydraulic section.

The hydraulic section, with the fuel inlet and return lines, comprises the solenoid-operated injection valve, temperature sensor (air), and the pressure regulator. This regulator maintains a constant fuel pressure at the solenoid-operated injection valve. Consequently, the quantity of fuel injected depends exclusively on how long the solenoid-operated injection valve is open. The pressure regulator is not a separate component, but is integrated in the hydraulic section.

As well as the throttle-valve and its mounting, the double potentiometer and the electric idle actuator are built on to the throttle-valve section.



Throttle-body injection unit

1 = Hydraulic section
2 = Fuel inlet line
3 = Fuel return line
4 = Decoupling intermediate plate
5 = Pressure regulator
6 = Fastening screw
7 = Valve holder with temperature sensor (air)
8 = Sealing rings
9 = Ring strainer
10 = Stud bolt for air-filter mounting
11 = Solenoid-operated injection valve
12 = Throttle-valve section
13 = Intake-manifold pressure connection
14 = Throttle valve

A = Fuel pressure
B = Pressureless
C = Injection cone

Solenoid-operated injection valve

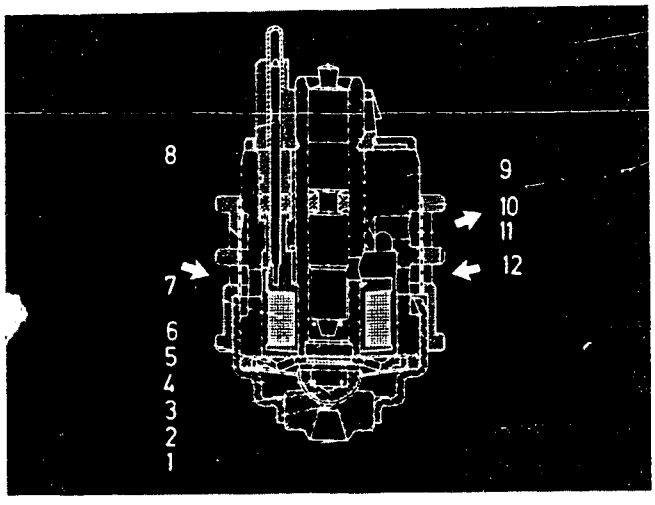
To guarantee homogeneous mixture formation and good mixture distribution for all cylinders, the injection valve is located above the throttle valve. Instead of a pintle, the fuel is atomized by a combination of baffle and swirl effects. The fuel impacts against the wall of the conical mixture-preparation chamber. The conical spray pattern is produced by six diagonally extending holes. The spray angle is such that the fuel impacts directly into the sickle-shaped gaps between housing and throttle valve.

In order to be able to meter even minute quantities of fuel with accuracy, the flat armature, valve ball, and diaphragm spring have only a small mass and in this way permit very short injection-valve switching times.

To prevent vapor locks, there is a constant flow of fuel through the solenoid-operated injection valve. This contributes toward excellent hot-starting and hot-fuel performance.

Solenoid-operated injection valve

1 = Spay edge
2 = Spray holes
3 = Valve ball
4 = Valve spring
5 = Diaphragm spring
6 = Flat armature
7 = Solenoid
8 = Electrical connection
9 = Valve body
10 = Ring strainer
11 = Fuel outlet
12 = Fuel inlet



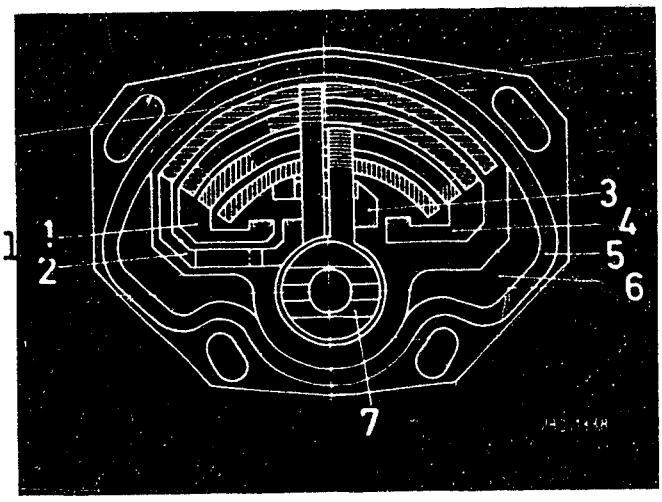
MEASURING OF OPERATING DATA

Intake-air flow
The deflection (opening) of the throttle valve informs the engine of the load condition desired.
The double potentiometer secured on the throttle-valve section passes a voltage corresponding to the throttle-valve position to the control unit. For better resolution, particularly in the part-load range, the double potentiometer has a two-track design – separate wipers.

The air demand corresponds to the throttle-valve position and the engine speed. Both variables determine the basic duration of injection.

Double potentiometer

1=Ground connection of both resistance tracks
2=Connection for wiper track, potentiometer I (idle – part load)
3=Connection for wiper track, potentiometer II (part load – full l
4=Voltage supply (positive from control unit)
5=Groove for seal ring
6=Potentiometer housing
7=Double wiper, insulated



Idle/Full load

Detection of the idle mode is performed by the idle contact at the electric actuator. This is necessary for low-idle speed control and overrun cut-off.
The full-load mode is detected via the position of the double potentiometer and enriched accordingly.
An otherwise customary throttle-valve switch is no longer applicable.

Further operating data

Engine speed, engine temperature, intake-air temperature and battery voltage are detected and evaluated in exactly the same way as with the L-Jetronic.

LAMBDA CLOSED-LOOP CONTROL

As with the LU-Jetronic, the lambda closed-loop control circuit is built up with the lambda sensor. The sensor measures the remaining oxygen in the exhaust-gas flow in all load ranges.
In the control unit the pre-calculated duration of injection (pilot control) is influenced by the sensor signal. In this way, it is possible to make optimum use of a 3-way catalytic converter for the reduction of pollutants.

See microcard PKW 038, Coordinate B22 for supplementary information.

Scope of control-unit function

Inputs	Functions	Outputs
Throttle-valve potentiometer	Starting control Post-start enrichment Warm-up enrichment Acceleration enrichment Full-load enrichment Pump control	Injection valves Fuel pump relay
Engine speed		
Engine temp.		
Intake-air temperature	Lambda charac. map Overrun cut-off Eng.-speed limitation	Monitoring lambda sensor
Lambda sensor	Lambda cl.-loop cont. Adaptive functions Diagnosis Limp-home function Hot-starting control	Diagnosis
Idle	Adaptive low-idle-speed control	Electric actuator (idle)
Air conditioner		
Transmission switch (automat.)		

CONTROL-UNIT FUNCTIONS

The digital control unit processes the signals of the inputs and calculates from them the duration of injection for the injection valve. Comprised in the control unit are a microcomputer, program memory and data memory, together with an analog-digital converter.

Basic injected quantity

The control unit generates the basic duration of injection from the throttle-valve-angle signal and the engine-speed signal. For this purpose, a map is stored.

This comprises: 15 throttle-valve-angle data points and
15 engine-speed data points.

The 225 data points contain the appropriate durations of injection for lambda = 1.0 as applied. This 15 x 15 basic map comprises different zones in which correction takes place in different ways. By means of this adaptation, the tolerances and drifts of the engine and of the injection system are compensated for, just as leakage air or incorrect density of intake air are compensated for.

Enrichment functions

As is the case with the LE2-Jetronic, enrichment is performed during cold starting, post-start and warm-up via the duration of injection.
For full load, the duration of injection is programmed in the control unit and is specific to the engine in question.

Fuel cut-off

Takes place in overrun and above the maximum engine speed.

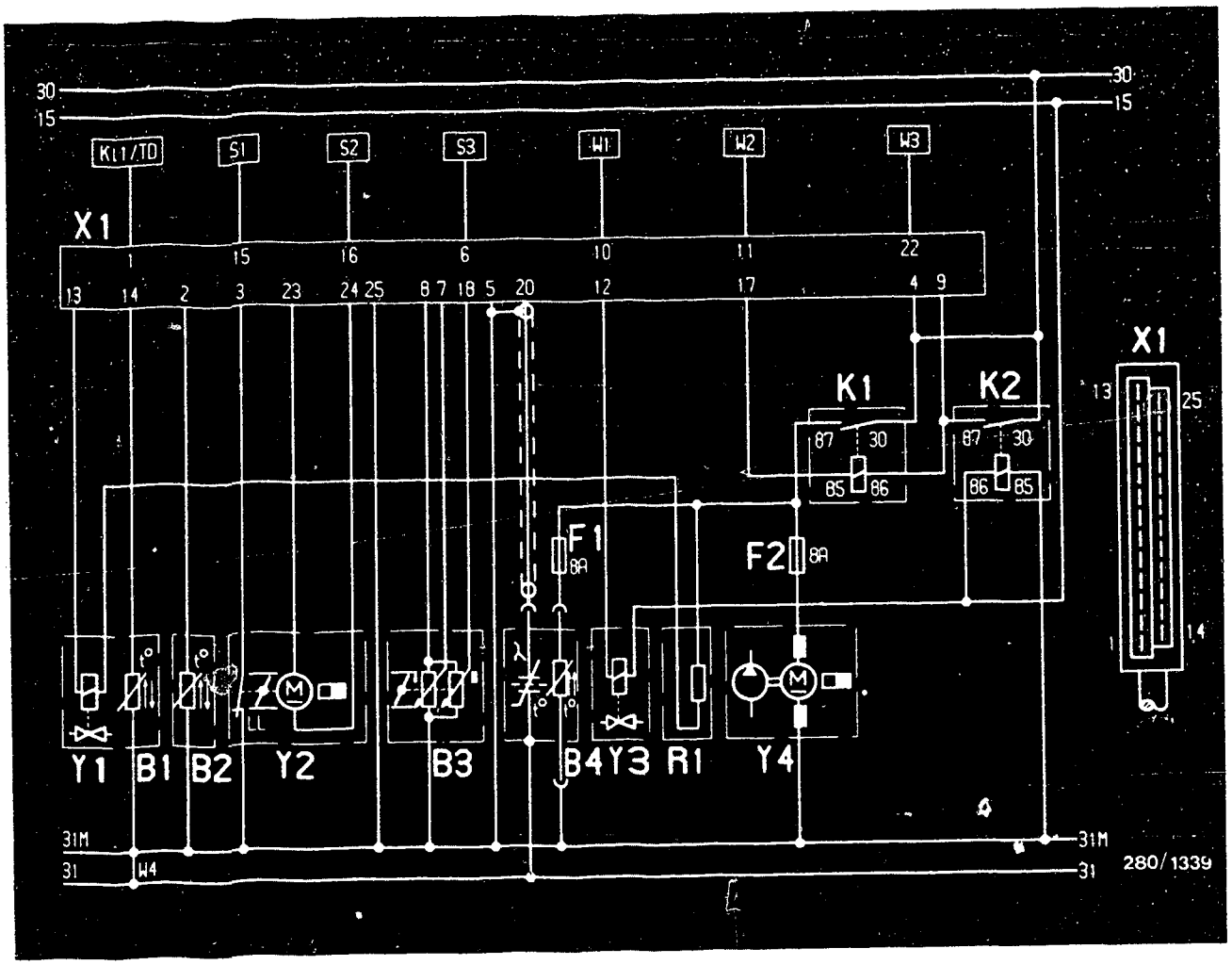
Adaptive closed-loop idle-speed control

This control function is made use of for stabilizing a lower idle speed. For this purpose, an electric actuator (electric motor with gearing and idle switch) adjusts the throttle-valve position. The electric actuator is energized by the control unit.

POSSIBILITIES FOR TESTING

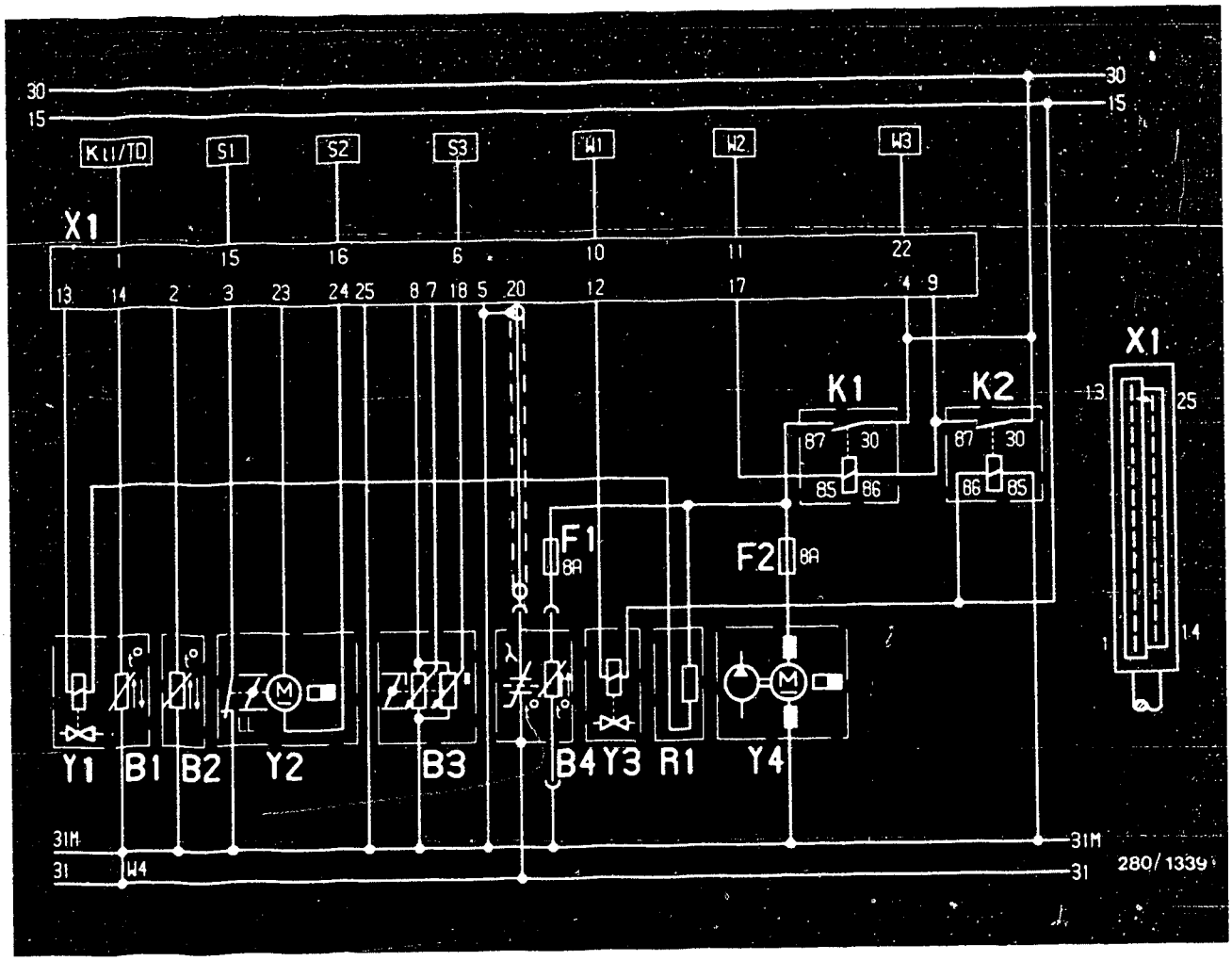
In addition to self-diagnosis, it is possible to use the universal test adapter with the system adapter lead.

Universal test adapter	0 684 101 801
Single-wire line	1 684 463 170



Electrical terminal diagram

B1 = Temperature sensor I (air)
B2 = Temperature sensor II (engine)
B3 = Throttle-valve potentiometer
B4 = Lambda sensor (heated)
F1 = Fuse (sensor heating)
F2 = Fuse (electric fuel pump)
K1 = Pump relay
K2 = Main relay
R1 = Series resistor (if present)
S1 = Air-conditioner standby
S2 = Air-conditioner compressor
S3 = Transmission switch



Electrical terminal diagram (continued)
W1 = tV-Coding
W2 = Pump coding
W3 = Diagnosis
W4 = Ground strap, engine
X1 = Control-unit plug
Y1 = Solenoid-operated injection valve
Y2 = Electric actuator (idle)
Y3 = Tank ventilating valve
Y4 = Electric fuel pump

Published by:
Robert Bosch GmbH Division KH
After-Sales Service Dept. for Training and Tech. (KH/VSK)
Please direct questions and comments concerning the contents to our authorized representative in your country.

Exchanging the brake linings / Basic setting

1. Clean the area around the screw plug (17) and then remove the screw and the housing holding spring (1).

2. Unscrew the hexagon-socket (width across flats 7 mm) guide pin from the holder, but do not push out of the guide sleeve. Remove the housing (2) and hang up in such a way that the brake-hose line is not subjected to any tensile load.

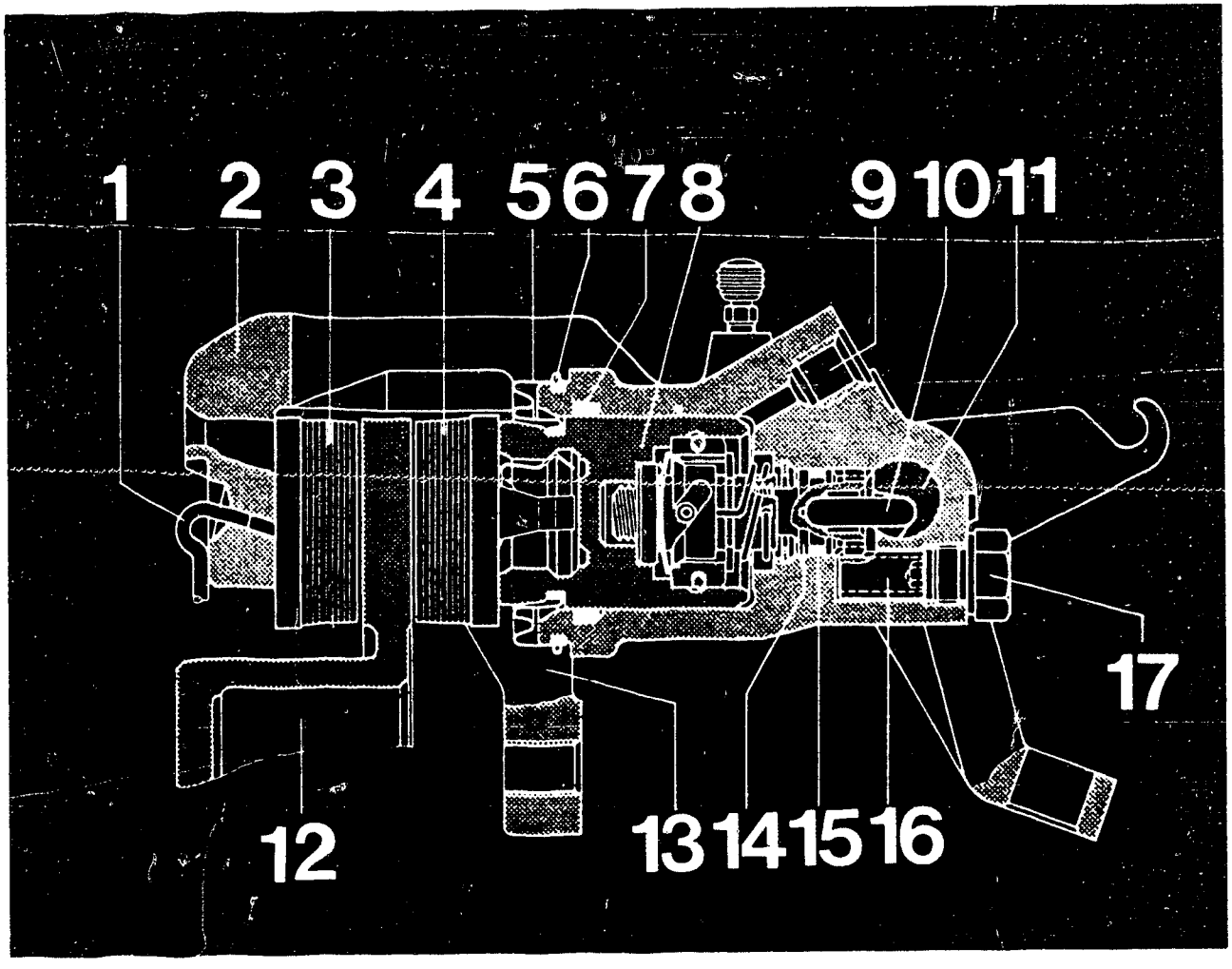
3. Pull out the linings, clean the guide surfaces of the brake linings, and check the parts for damage.

4. Retract (push back) the piston, always holding the piston under prestress using the piston-retracting device, and at the same time screw back the return shaft (16) using the hexagon socket (width across flats 4 mm). Retract the piston until it is flush with the cylinder housing.

   A t t e n t i o n !
   Retracting the piston further may lead to irreparable damage.
   Pay attention to the brake-fluid level in the reservoir; if necessary, syphon some fluid off.

5. Clip the lining with the lining holding spring (4) into the piston (8) and insert the second lining into the guide surfaces of the holder.

6. Position the housing (2) on the holder (13).
   A t t e n t i o n !
   Do not twist the brake-hose line.



1 = Housing holding spring
2 = Housing
3 = Brake lining
4 = Brake lining, complete
5 = Protective cap
6 = Clamping ring
7 = Square seal ring
8 = Piston, complete
9 = Threaded connection
10 = Pressure piece
11 = Activating shaft
12 = Brake disc
13 = Holder
14 = Drive spindle
15 = O-ring
16 = Return shaft
17 = Screw plug

7. Screw the hexagon-socket (width across flats 7 mm) guide pin into holder to 25...30 Nm and tighten. Push on protective plug.

8. Insert the housing spring, making sure that the spring is seated correctly in the housing bores at both ends.

9. By turning the return shaft (16), set a clearance of 0.3 mm between the brake lining and brake disc.
   A t t e n t i o n !
   If the basic clearance between the lining and disc is not set correctly, the self-adjusting facility may be damaged or put out of operation when pressure is built up.

10. Tighten screw plug (17) to 12...16 Nm.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales-Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Exchanging the brake linings / Basic setting

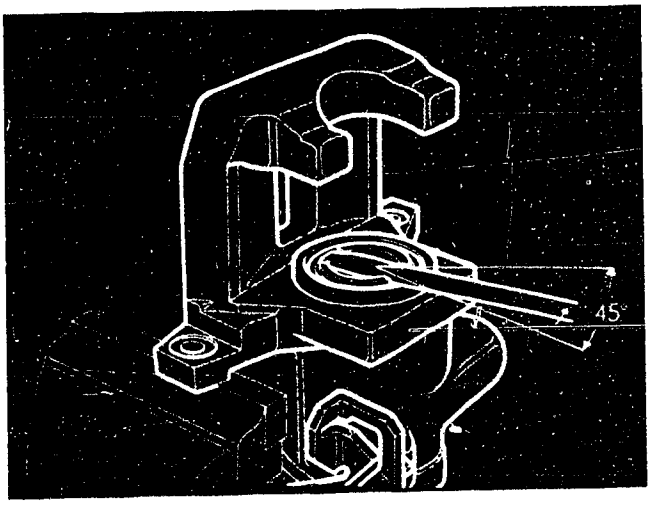
1. Loosen fastening screw and, if possible, pivot the housing upwards.
   If the installation conditions do not permit this, the other fastening screw must also be loosened.

2. Remove the brake linings; if necessary, remove the lining holding spring built in, beforehand.

3. Clean the lining guide surfaces.
   Check the protective caps of the piston and the gaiter seals for damage, and check the guide pin for freedom of movement.

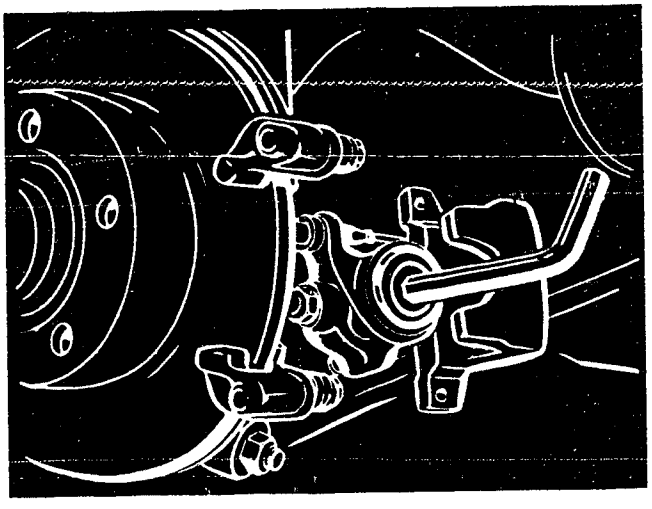
4. Before pushing back the piston, syphon off brake fluid from the reservoir in order to prevent an overflow.

5. Retract the piston.
There are two differing methods dependent upon the type of floating caliper:



5.1 Using the piston turning wrench/screwdriver, turn the piston through 45° (see above). Push the piston as far as it will go into the housing. Then turn the piston back by 45°, so that the tooth profiles engage again.

5.2 Screw in the piston by turning clockwise using the piston return tool (KDHB 0001)(center and lower illustration).



6. Insert the new brake linings; if necessary, mount the lining holding spring. The linings should be freely moveable.

7. Pivot the housing downward, perform the basic setting, and tighten with new screws to 35 Nm.

7.1 In the case of the brake-caliper type shown in the upper illustration, the linings must be brought into contact by repeated actuation of the brake.

7.2 In the case of the brake-caliper types shown in the center and lower illustrations, the basic setting is set by turning the piston and this setting must be less than 1 mm.
Afterwards, actuate the brake several times.

8. Resetting of the handbrake is necessary only if the brake calipers, housing, handbrake cable or the brake discs have been replaced.

N O T E :

In order to enable the brake linings to become adapted to the brake disc and thus to achieve the best performance and longest service life, the vehicle user is recommended by the manufacturer to adapt his style of driving for the first 200 km (125 miles) after installation of new linings, so as to avoid any unnecessarily violent braking.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

PORSCHE WITH ABS
HYDRAULIC MODULATORS FOR 928 AND 944/951

Motor vehicle: PASS. CAR
09.1987

0033 En

As of Sept. 1987, the ABS hydraulic modulators installed in the above-mentioned vehicles will no longer be fitted in series production, being replaced by hydraulic modulators with a lower hood. This change also requires a change to the engine relay and valve relay.

This leads to the following changes:

ABS hydraulic modulator from 0 265 200 009 to 0 265 200 039
(Type 928)
ABS hydraulic modulator from 0 265 200 028 to 0 265 200 038
(Type 944/951)
Engine relay from 0 265 003 003 to 0 332 002 171
(Type 928/944/951)
Valve relay from 0 265 205 003 to 0 332 205 004
(Type 928/944/951)

The new versions of the ABS hydraulic modulator differ from the previous versions in that they have a smaller constructional volume and use the new valve relay with integrated diode. This diode was previously accommodated in the plug-in base of the ABS hydraulic modulator.

The new ABS hydraulic modulators are identical to the preceding versions with respect to installation and operation. Application of the conventional engine relay and valve relay on the new hydraulic modulators is, however, no longer possible. Likewise, the previous versions of hydraulic modulator may no longer be installed as replacements in vehicles which have already been equipped with the new hydraulic modulators.

Published by:
ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

MIXTURE ADAPTATION AND CORRECTION OF SPARK ADVANCE WITH MOTRONIC CONTROL UNITS WITH PC-BOARD SWITCH

Motor vehicle: PASS.CAR
11.1987

0046 En

This bulletin is intended to give the Motronic expert the necessary overall view with regard to the possibilities for influencing the fuel-injection map and ignition characteristic map of the Motronic control units by means of a PC-board switch.

Listed in the following table are areas of application/faults under complaint, and corresponding measures:

Table 1 – Influence on fuel injection,
Table 2 – Change of spark advance.

The following pages contain mark-related and control-unit-related switch positions of the PC-board switch and their effects.

Possibilities of influencing fuel-injection and ignition characteristic maps (muliplicative, i.e. throughout the whole engine-speed and load ranges).

Table 1:

Mixture	Area of application	Possible effects
Enrich-ment (+ %)	-Bucking -Poor throttle response -CO too lean and cannot be adjusted	-Better throttle response -Increased fuel consumption -CO increase
Leaning (- %)	-High fuel consumption -CO too rich and cannot be adjusted	-Bucking/poor throttle response -Consumption lower -Rise in nitrogen monoxide

Table 2:

Ignition	Area of application	Possible effects
Retarda-tion (- °crank -shaft	-Engine pings and/or runs on (diesels) -Lower fuel quality (octane rating too low)	-Greater or lesser loss of power depending upon degree of adjustment -Increased consumption
Advance (+ °crank -shaft)	-Power/torque too low -Increased fuel consumption	Caution! Advancing the igni-tion (e.g. with octane rating remaining identical) may lead to engine damage. -Increase in torque -Reduction of consumption -Rise in nitrogen monoxide

PC-board switch for Alfa Romeo:

Switch position	Mixture adjustment (%)	Control unit no. 0 261 200 ..		
	Spark-advance adjustment (° crankshaft)	..040 ..044 -> 6.83	..044 7.83 ->	..063
0	Mixture	0	0	0
	Spark advance	0	0	0
1	Mixture	+3	+3	+3
	Spark advance	0	0	0
2	Mixture	-3	-3	-3
	Spark advance	0	0	0
3	Mixture	-6	+6	+6
	Spark advance	0	0	0
4	Mixture	0	0	0
	Spark advance	-4	+4	+4
5	Mixture	+3	+3	+3
	Spark advance	-4	+4	+4
6	Mixture	-3	-3	-3
	Spark advance	-4	+4	+4
7	Mixture	-6	+6	+6
	Spark advance	-4	+4	+4

PC-board switch for BMW:

Switch position	Mixture adjustment (%) – / Spark-advance adjustment (°crankshaft)	Control unit no. 0 261 200 ..		
		...002 ...004	...011 ...018 ...019 ...040 ...043 ...060 ...061 ...064	...013 ...024 ...025
0	Mixture	0	0	0
	Spark advance	0	0	0
1	Mixture	+3	+3	+3
	Spark advance	0	0	0
2	Mixture	–3	–3	–3
	Spark advance	0	0	0
3	Mixture	–6	+6	+6
	Spark advance	0	0	0
4	Mixture	0	0	0
	Spark advance	–4	+4	+4
5	Mixture	+3	+3	+3
	Spark advance	–4	+4	+3
6	Mixture	–3	–3	–3
	Spark advance	–4	+4	+4
7	Mixture	–6	+6	+6
	Spark advance	–4	+4	+4

PC-board switch for BMW (continued)

Switch - position	Mixture adjustment (%)	Control unit no. 0 261 200 ..			
	- Spark-advance adjustment (° crankshaft)	..042 ..045	..055	..073 ..074 ..081 ..083	..071 ..079
0	Mixture	0	0	0	0
	Spark advance	0	0	0	0
1	Mixture	+4	+6	+6	+4
	Spark advance	0	0	0	0
2	Mixture	-4	+10	-6	+10
	Spark advance	0	0	0	0
3	Mixture	-6	-6	0	-4
	Spark advance	0	0	-2,5	0
4	Mixture	0	0	+6	0
	Spark advance	-2,5	-5,5	-2,5	-3
5	Mixture	+4	+6	-6	+4
	Spark advance	-2,5	-5,5	-2,5	-3
6	Mixture	-4	+10	0	+10
	Spark advance	-2,5	-5,5	-4	-3
7	Mixture	-6	-6	+6	-4
	Spark advance	-2,5	-5,5	-4	-3

PC-board switch for Porsche:

Switch position	Mixture adjustment (%) / Spark-advance adjustment (° crankshaft)	Control unit no. 0 261 200 .. ...050 ...051 ...078 ...082 ...084 ...085	...006 ...015 ...016 ...053 ...054 ...057 ...058 ...075 ...076 ...077 ...080	...052
0	Mixture	0	0	0
	Spark advance	0	0	0
1	Mixture	+3	+3	+4
	Spark advance	0	0	0
2	Mixture	+6	−3	+6
	Spark advance	0	0	0
3	Mixture	−4	+6	−4
	Spark advance	0	0	0
4	Mixture	0	0	0
	Spark advance	−3	−3	−3
5	Mixture	+3	+3	+4
	Spark advance	−3	−3	−3
6	Mixture	+6	−3	+6
	Spark advance	−3	−3	−3
7	Mixture	−4	+6	−4
	Spark advance	−3	−3	−3

PC-board switch for Volvo :

Switch position	Mixture adjustment (%)	Control unit no. 0 261 200 ..	
	Spark-advance adjustment (° crankshaft)	...022 ...023 ...026	...012
0	Mixture	0	0
	Spark advance	0	0
1	Mixture	+3	+3
	Spark advance	0	0
2	Mixture	+6	+6
	Spark advance	0	0
3	Mixture	−3	−2
	Spark advance	0	0
4	Mixture (%)	0	0
	Spark advance	−4	−4
5	Mixture	+3	+3
	Spark advance	−4	−4
6	Mixture	+6	+6
	Spark advance	−4	−4
7	Mixture	−3	−2
	Spark advance	−4	−4

Published by: Robert Bosch GmbH Division KH
After-Sales-Service Department for
Training and Technology KH/VSK
Please direct questions and comments concerning the contents to our authorized representative in your country.

NEW SYSTEM

Motor vehicle: PASS. CAR
11.1987

ELECTRONIC TRACTION CONTROL (ASR) FOR PASSENGER CARS

0047 En

Reasons for introduction:

As a logical extension to the ABS, Bosch has developed electronic traction control (known as ASR for short) which throughout the whole speed range prevents the driving wheels from spinning on acceleration.

Control over the vehicle is lost or considerable restricted, if one or both of the driving wheels exceeds the limit of stability as a result of wheel slip being too great during acceleration.

With ASR, the engine transmits its propelling force to the road optimally via the driving wheels. Trouble-free driving off on snow-covered, icy, wet, or unmetalled road surfaces is guaranteed. In addition, on accelerating while driving, when the cornering force is reduced, the vehicle does not break away.

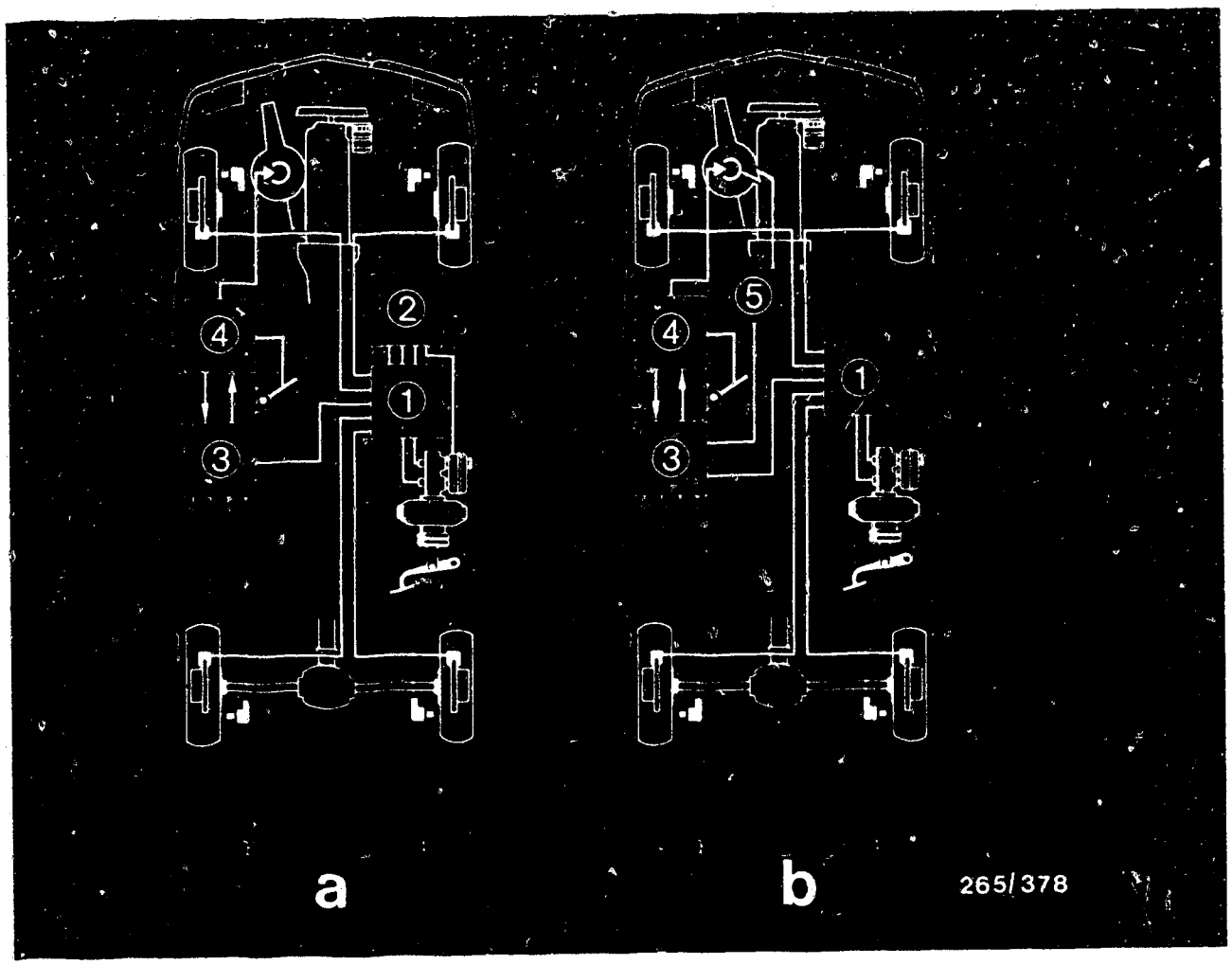
ASR acts more quickly and more precisely than the driver is capable of doing and thus relieves the stress on the driver. ASR ensures that the vehicle remains stable in certain situations which demand too much of the driver. This is the case as long as the physical limits are not exceeded. Particularly when the coefficient of friction of the roadway is low, the driver must actuate the accelerator pedal with a great deal of feeling. Above all in the case of high-powered, rear-wheel-driven vehicles, it is possible that the vehicle becomes unstable and even begins to swerve or slide if acceleration is too harsh or the throttle is released too suddenly.

Just as is the case when the vehicle is braked, slip develops between the tires and roadway when the vehicle is being driven off. The forces transmitted by the tires in the longitudinal and lateral directions are simliarly dependent upon the wheel slip or brake slip.

The most important function of the ASR is to reduce the engine torque, if necessary, to the level of drive torque which can be transmitted to the road in each case. ASR is supplemented in BMW vehicles by MSR (Engine Drag Torque Control) which optimally doses the engine braking moment in overrun.

Alongside stability on accelerating, forward propulsion can be improved particularly when driving off. Especially on road surfaces which pose greatly differing adhesion coefficients at the two driving wheels, ASR acts in the same way as a limited-slip differential by automatically braking the wheel which would otherwise spin.
This variant is at the moment being put to use only in Daimler-Benz vehicles.

The driver is optically informed when the ASR is operating by means of a lamp; i.e., the vehicle is close to the physical limit of stability.



Electronic traction control systems

a = Action on throttle valve and brake
b = Action on throttle valve and engine management
1 = ABS hydraulic modulator
2 = ASR hydraulic modulator
3 = ABS/ASR controller
4 = E-Gas control unit
5 = Motronic control unit.

The functions and advantages of ASR summarized:

- contribution toward active safety
- relieving the strain on the driver
- ensuring driving stability
- improvement of forward propulsion (traction)
- driver information

The technical concept

ASR operates in combination with ABS. The ABS controller is extended by an ASR component.
The extent of wheel slip to be calculated by the ASR system is obtained from the ABS wheel-speed-sensor signals. The ABS/ASR controller compares the signals from the driven and from the undriven wheels and using this information calculates the wheel slip of the driven wheels.
In the case of a fault, ASR can be switched off separately from the ABS. An ASR indicator lamp indicates failure to the driver.

ASR with engine action (ASR-DKZ/MSR) for BMW

DKZ = Throttle-valve control and ignition action
BMW designation, ASC = Automatic Stability Control.
The common feature of the ASR system is the action on the position of the throttle valve via the electronic accelerator pedal. If required, this action reduces the level of engine torque by closing the throttle valve, irrespective of how heavily the driver accelerates. The control commands from the ASR, including the MSR, are given priority by the electronic accelerator pedal (E-Gas) over the control input from the driver. Over and above that, depending upon the development goal of the automobile manufacturer, action is taken either on the brake by braking the spinning wheels, or on the ignition and injection via the Motoronic.

The relatively slow reaction time of action on the throttle valve is supplemented in BMW vehicles by additional action on the ignition and injection timing.
First of all, the ignition point is retarded. If this measure is not sufficient to reduce the level of slip, the ignition pulses are inhibited. In this case, the fuel injection must also be interrupted so that the concentration of pollutants in the exhaust gas is not increased to an impermissible level and that the catalytic converter is not overloaded. Interruption of the fuel injection alone results in rather more sluggish action, because the engine still intakes and combusts the fuel which has already been supplied.

As well as a high degree of driving stability, ASR provides improved forward propulsion as well on road surfaces with a homogeneous coefficient of friction by means of engine action. A mechanical limited-slip differential makes driving off under roadway conditions where the coefficient friction varies easier, this differential being offered as an extra.

Engine Drag Torque Control (MSR)

After shifting down gear or if the throttle is released abruptly in a low gear, and with the vehicle on a slippery roadway, the driving wheels may be affected by too high a level of brake slip due to the braking effect of the engine. To avoid this, the MSR system is applied which slightly increases the engine torque through slight acceleration, thus reducing the braking effect on the wheels to an optimum degree with respect to driving stability.

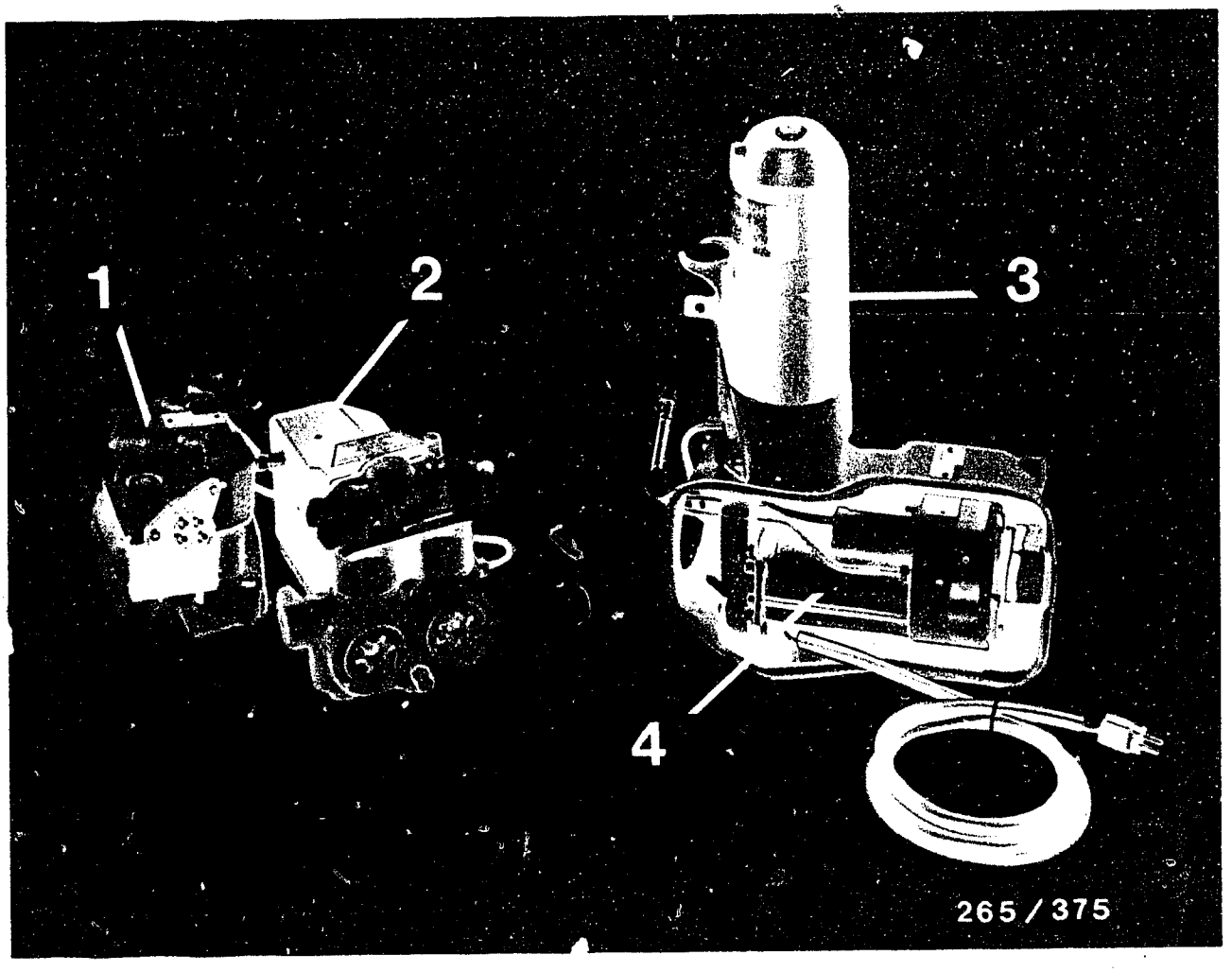
In addition, in cases in which the ABS is operative and the engine is engaged, the MSR increases the re-acceleration of the driving wheels if required.
For reasons of safety, the MSR operates only at vehicle speeds exceeding 10 km/h and limits the raising of the throttle valve to 18% of the maximum throttle-valve position.

Passive switching

The slip requirement for optimum forward propulsion when driving on very deep snow or with snow chains is greater than ASR permits. For this reason, the driver has the possibility to switch off the ASR by means of a switch or nonlocking switch.

ASR with engine and brake action (ASR-DKB)

for Daimler-Benz
DKB = Throttle-valve control and brake action.
In addition to the relatively sluggish action via the E Gas, rapid action is carried out on the brakes of the driving wheels when this DKB system variant is fitted.
Further ASR components are required for brake action: ASR hydraulic modulator, charging pump and accumulator.



ABS/ASR-DKB components:
1 = ASR hydraulic modulator
2 = ABS hydraulic modulator
3 = Accumulator
4 = Charging pump

At the same time, the brake action has the effect of a limited-slip differential and as well as improving driving stability, also improves traction, particularly on road surfaces with non-uniform coefficients of friction. When driving off on a road surface with differing coefficients of friction, the wheel with the lowest coefficient of friction spins and the other wheel remains motionless. The total engine torque is transmitted to the spinning wheel via the differential and the vehicle does not move from the spot. In this instance, ASR comes into operation, braking the spinning wheel by just the right amount.

A hydraulic energy-supply system in conjunction with the ABS solenoid-operated valves provides the brake action. The brake torque applied to the spinning driving wheel is then available to the second wheel as drive torque.

ASR-DKB version

The ABS hydraulic modulator operates in exactly the same way as the conventional 3-channel version; however, it has been altered with respect to the brake-line connections to enable coupling to the ASR hydraulic modulator. In order to make it possible to brake the driving wheels individually, it became necessary to fit a 4th brake channel. The solenoid-operated valve belonging to this is located in the ASR hydraulic modulator.

A further solenoid-operated valve in the ASR hydraulic modulator switches over from normal braking mode to ASR mode. In this way, the gas-pressure accumulator filled with brake fluid (pressure range 150...185 bar) applies brake pressure to the two driving wheels without the driver actuating the brake pedal. As with ABS, the solenoid-operated valves perform pressure modulation itself, these valves being able to adopt the three positions "pressure build-up", "pressure holding" and "pressure reduction". The pulsating actuation of the solenoid-operated valves is controlled by the ABS/ASR controller, if the control system detects the driving wheels tending to spin. When the ASR is operative, the return pump runs permanently along with it, in order to enable pressure reduction in the wheel-brake cylinders of the driving wheels. The brake fluid is pumped back into the accumulator.

No brake fluid is "lost" in the reservoir. The accumulator is charged by a high-pressure charging pump when the ABS/ASR is not operative.

Published by:

Robert Bosch GmbH
Division KH
After-Sales-Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

ANTISKID SYSTEM (ABS) WITH ELECTRONIC TRACTION CONTROL (ASR)

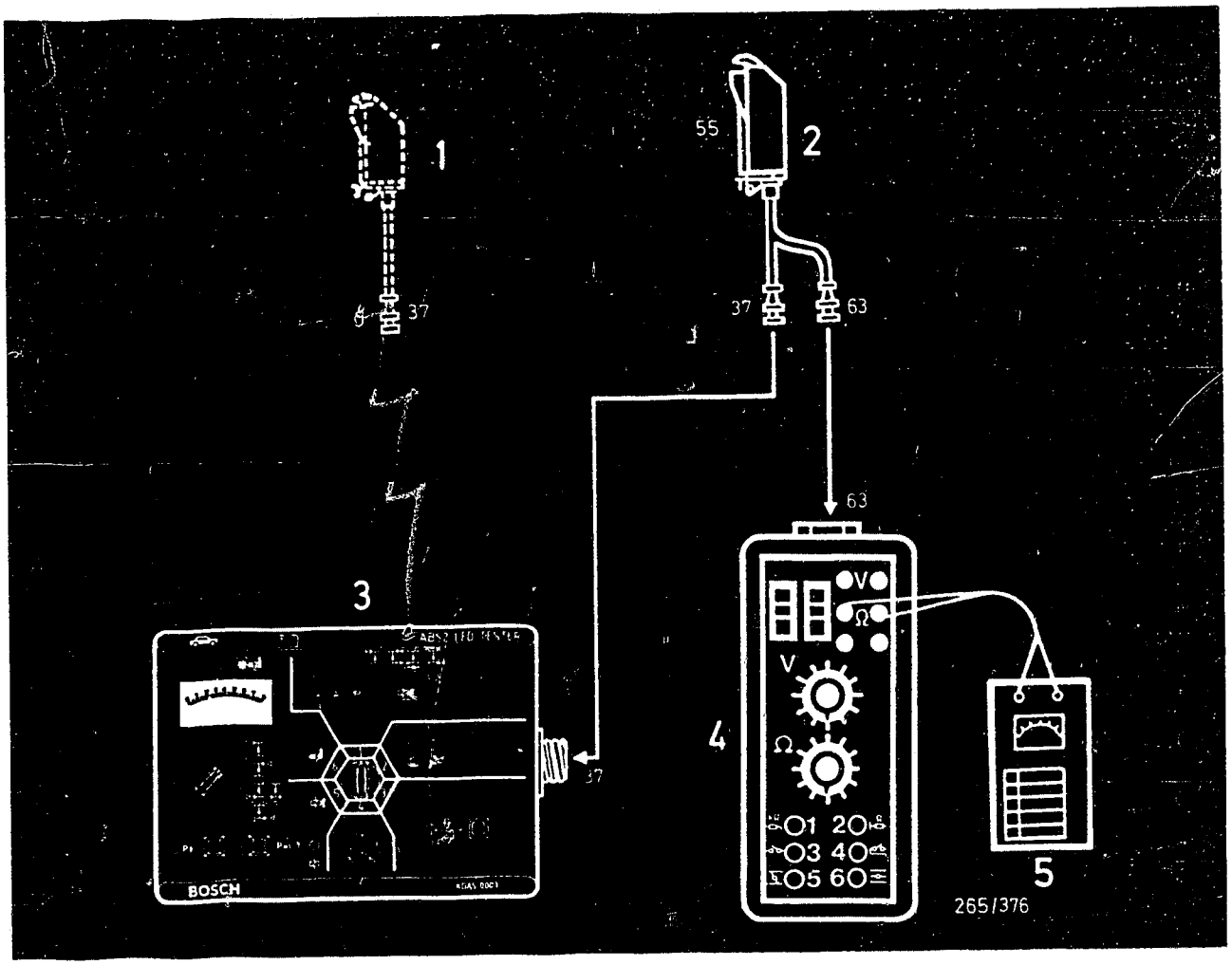
Procedures for after-sales service:

Since mid-1987, the BMW vehicles of type 735 with 3.43 l engine are being equipped with an electronic traction control system based on ABS 2.

This ASR system with throttle-valve-control ignition action (DKZ) / engine-drag torque control (MSR) operates without brake intervention in conjunction with E Gas (electronic accelerator pedal) and Motronic.

ABS/ASR DKZ/MSR is described in detail in the Service Information sheet entitled "New Product".

The ABS components remain unchanged; only the ABS controller is expanded by the ASR component.



1 = Test lead for ABS2 LED tester, 35-pin
(is not required)
2 = Test lead for ABS/ASR, 55-pin
3 = ABS2 LED tester (tests ABS2 section)
4 = Universal test adapter (tests ASR section)
5 = Multimeter

Testers ABS/ASR DKZ/MSR

In addition to the ABS tester KDAS 0003, the following testers are required for testing the ASR:

- Universal test adapter Part No. 0 684 101 801
- Test lead
- Multimeter

The necessary test lead is expected to be available as of spring 1988. Until it is delivered as standard, the test lead with provisional test instructions may, if required, be requested from

Reinhold Mack GmbH & Co
Jahnstr. 144
D-7320 Göppingen
Tel. 07161/78051
Telex 727865 mackd

The fact that the ABS/ASR system is an item of safety equipment forbids the use of any method of makeshift trouble-shooting.

Technical Documents

Testing/Repairing	SIS-KFz ...
Equipment	AP ...
Specifications	KE ...
Exchange	Exchange list
Product/Application	GD ...

Warranty procedure

Components on which a claim is being made should be sent for inspection during the warranty period to our representative in your country. He should forward it to:

Robert Bosch GmbH
KH/LAV - Auspackraum
zur Weiterleitung an K1/VAK
D-7500 Karlsruhe 41

together with warranty application, goodwill application and delivery note.

Published by: ROBERT BOSCH GMBH, Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

MERCEDES-BENZ VEHICLES, TYPE W 126 / C 126 — Motor vehicle: Pass. Car

12.1987

ANTISKID SYSTEM (ABS) WITH ELECTRONIC TRACTION CONTROL (ASR)

0049 En

Procedure for after-sales service

Since mid-1987, the vehicles of the W126 and C 126 (V8 with automatic transmission) series equipped with ABS as standard are equipped with E Gas and ASR on special request.

The electronic traction control system is described in detail in the Service Information sheet entitled "New System".

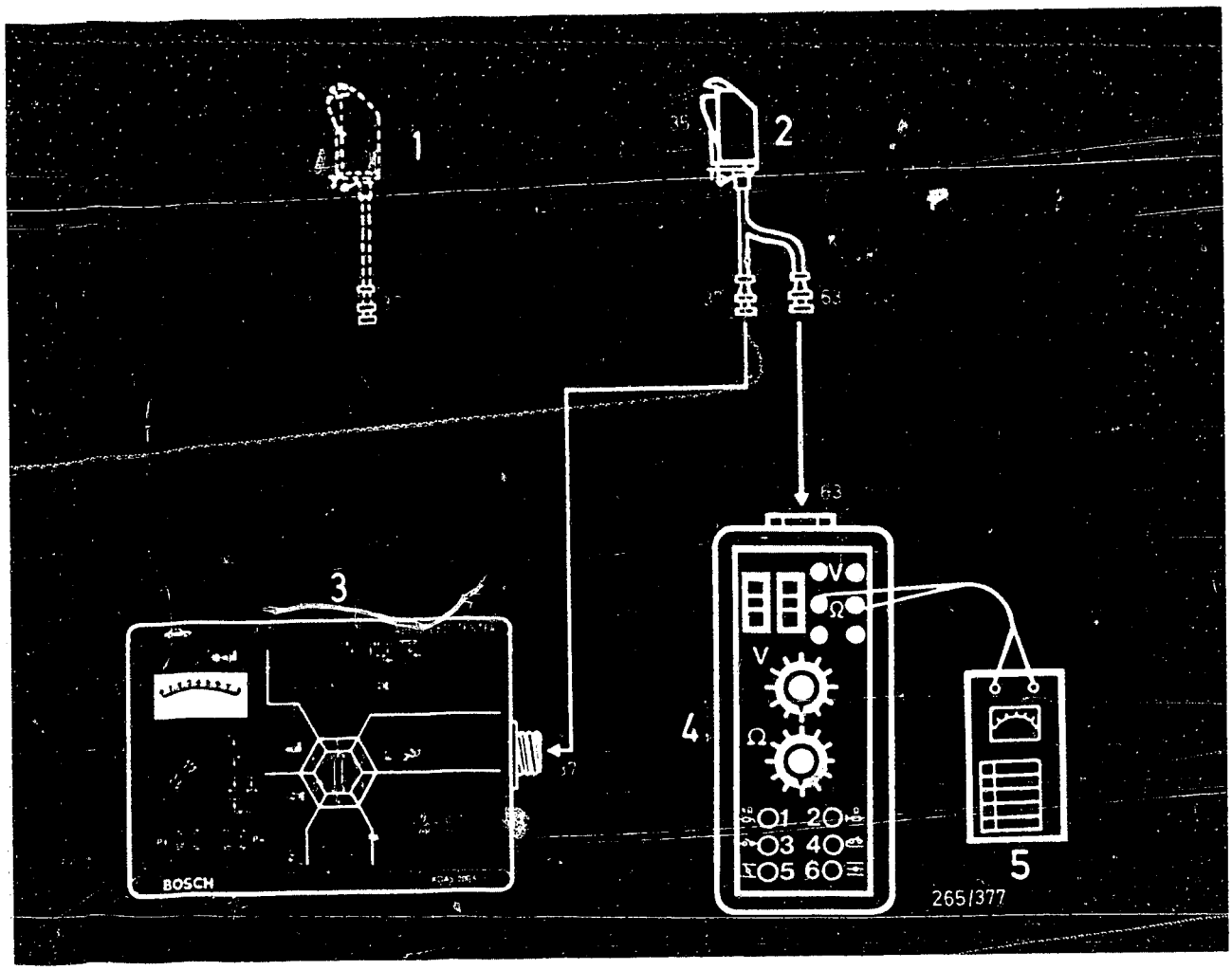
Additional ASR components

The following new ASR components are fitted in addition to the ABS components already known:

- ASR – Hydraulic modulator
- ASR – Pressure supply consisting of:
  - * ASR high-pressure charge pump
  - * ASR gas-filled floating-piston accumulator

In the same way as ABS components, these ASR components are not allowed to be repaired.

A special ABS hydraulic modulator has been adapted to suit the vehicles equipped with ASR. This special hydraulic modulator must not be installed in vehicles without ASR.



1 = Test lead for ABS2 LED tester, 35-pin
(is not required)
2 = Test lead for ABS/ASR, 35-pin
3 = ABS2 LED tester (tests ABS2 section)
4 = Universal test adapter (tests ASR section)
5 = Multimeter

Testers ABS/ASR

In addition to the ABS2 LED tester KDAS 0003, the following testers are required for testing the ABS/ASR:
- Universal test adapter Part. No. 0 684 101 801
- Test lead
- Multimeter
- Combination pressure tester W 0112 (FAG or other manufacturer)

The necessary test lead is expected to be available as of spring 1988. Until it is delivered as standard, the test lead with provisional test instructions may, if required, be requested from

Reinhold Mack GmbH & Co
Jahnstr. 144
D-7320 Göppingen
Tel. 07161/78051
Telex 727865 mackd

The fact that the ABS/ASR system is an item of safety equipment forbids the use of any method of makeshift trouble-shooting.

Technical Documents

Testing/Repairing	SIS-KFz ...
Equipment	AP ...
Specifications	KE ...
Exchange	Exchange list
Product/Application	GD ...

Warranty procedure

Components on which a claim is being made should be sent for inspection during the warranty period to our representative in your country. He should forward it to:

Robert Bosch GmbH
KH/LAV – Auspackraum
zur Weiterleitung an K1/VAK
D-7500 Karlsruhe 41

together with warranty application, goodwill application and delivery note.

Published by: ROBERT BOSCH GMBH, Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

FORD ESCORT RS TURBO 1.6 l

Motor Vehicle: Pass. Car
02.1988

Part-load bucking

0059 En

If there is bucking when driving and poor throttle response (part-load range approx. 2000...3000 min $^{-1}$) with the above-mentioned vehicle with KE-Jetronic and fuel distributor 0 438 101 031, the pressure actuator 2 437 020 006 on the fuel distributor must be replaced by the pressure actuator parts set 3 437 010 052.

The conversion is not free of charge.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

FIAT REGATA 75, STRADA 75, UNO 75 WITH
138 C ENGINE WITH CATALYTIC CONVERTER

Motor Vehicle: Pass. Car
02.1988

Bucking in part-load range

0060 En

If bucking in the part-load range (approx. 1800...2500 min $^{-1}$) arises in the above-mentioned vehicles with L-Jetronic and TCI-I, this may be caused by the following:

Connections at term. A + B of the magnetic-pulse-generator coil of the ignition distributor mixed up or connections on trigger box 0 227 100 029 mixed up.

Correct connections

Term. A of the magnetic-pulse-generator coil goes to term. 7 of the trigger box, term. B to term. 31 d.

Any necessary conversion is not free of charge.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

FIAT REGATA 75, STRADA 90

Motor Vehicle: Pass. Car
02.1988

Engine 149 C 1.6 l with Mono-Jetronic

0061 En

Starting problems

The ignition lock from Magneti Marelli installed may lead to a short voltage dip at term. 15 when the ignition key is released from the starting-motor position.

The supply voltage for the ignition control unit (Marelli Digiplex 2) and for the term. 1 signal of the ignition coil to the Jetronic control unit is thus interuppted for a short time.

R e s u l t :

Large drop in engine speed; engine may stall.

R e m e d y :

Exchange the ignition lock for one from a second supplier (Citea).
The ignition lock is not supplied by Bosch.
Any necessary conversion is not free of charge.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

ADJUSTABLE FUEL-PRESSURE REGULATOR
B 280 500 .. FOR L-JETRONIC AND
MOTRONIC SYSTEMS

Motor Vehicle: Pass. Car
02.1988

0064 En

For COMPETITION VEHICLES, BOSCH offers adjustable pressure regulators under Part No. B 280 500 .. .

Installation in vehicles which are registered for use on public roads is not permitted without local TÜV acceptance.

These special pressure regulators must be ordered directly from BOSCH MOTOR SPORT SERVICE K3/MSD.

Delivery via KH is not possible.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

NEW SYSTEM

Motor vehicle: Pass. Car
02.1988

ACTIVE BUCKING DAMPING (ARD) WITH SERVO MAGNET ON INJECTION-PUMP GOVERNOR RSF II

0065 En

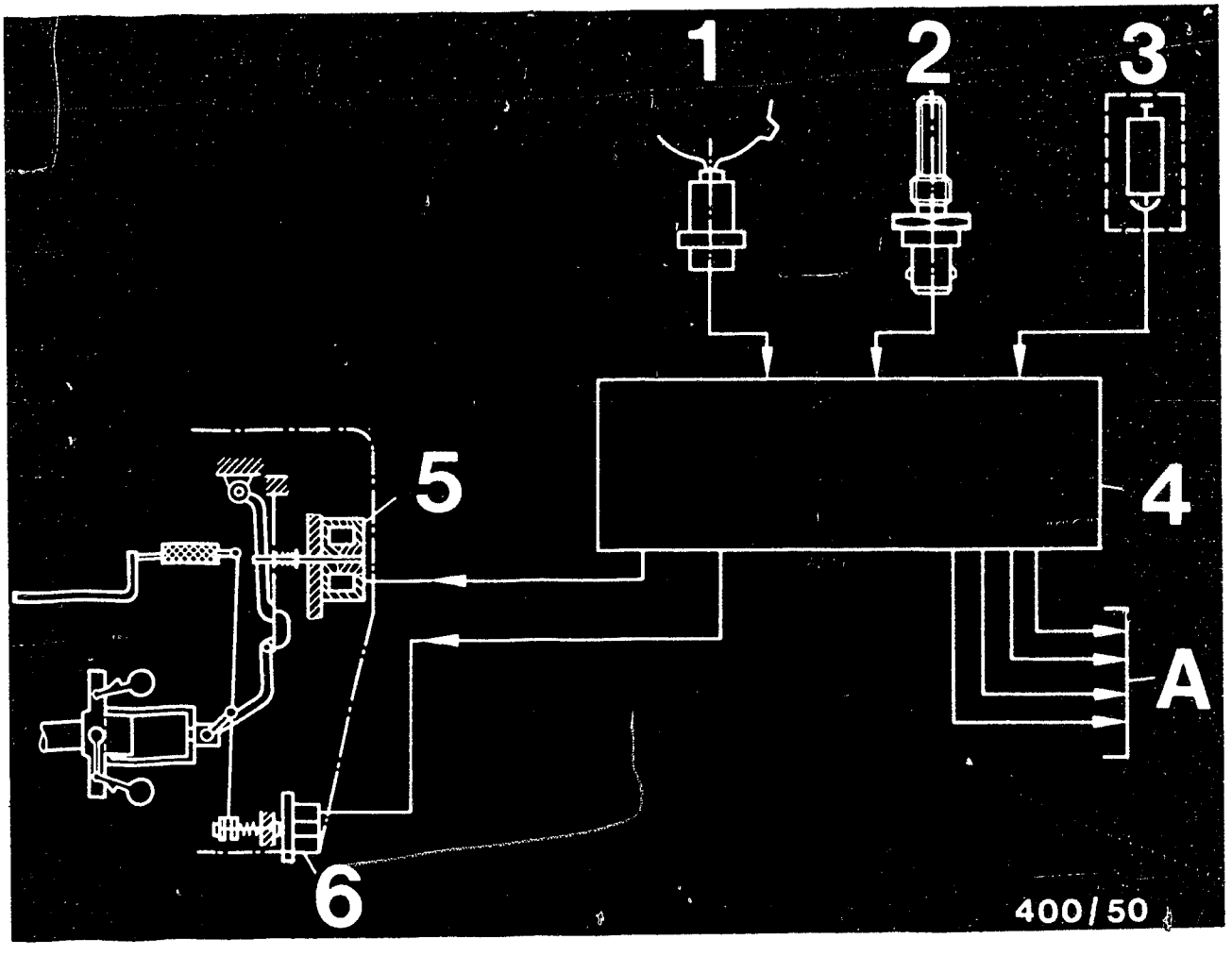
in DB vehicles (602 and 603 engines) with mechanical transmission

To damp the tendency to buck in vehicles with mechanical transmission, a servo magnet (active bucking damping) is mounted on the injection-pump governor (RSF II). This servo magnet reduces the quantity of fuel injected.

The servo magnet is activated by an electronic control unit.

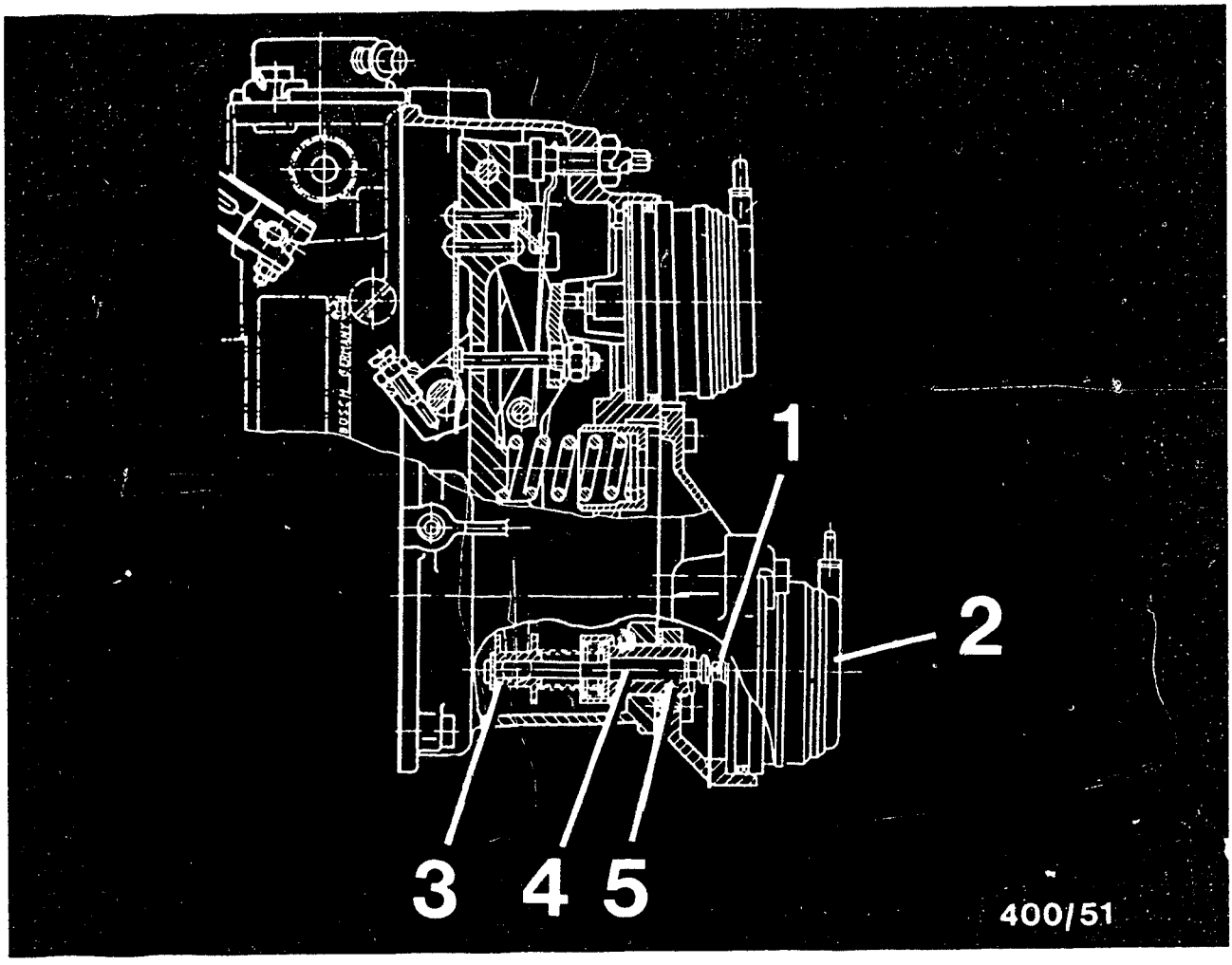
The control unit comprises the following functions:

* With the 603 engine, electronic low-idle speed control (ELR) and ARD.
* With the 602 engine with pneumatic idle increase (PLA), the control unit has only ARD.
* System diagnosis



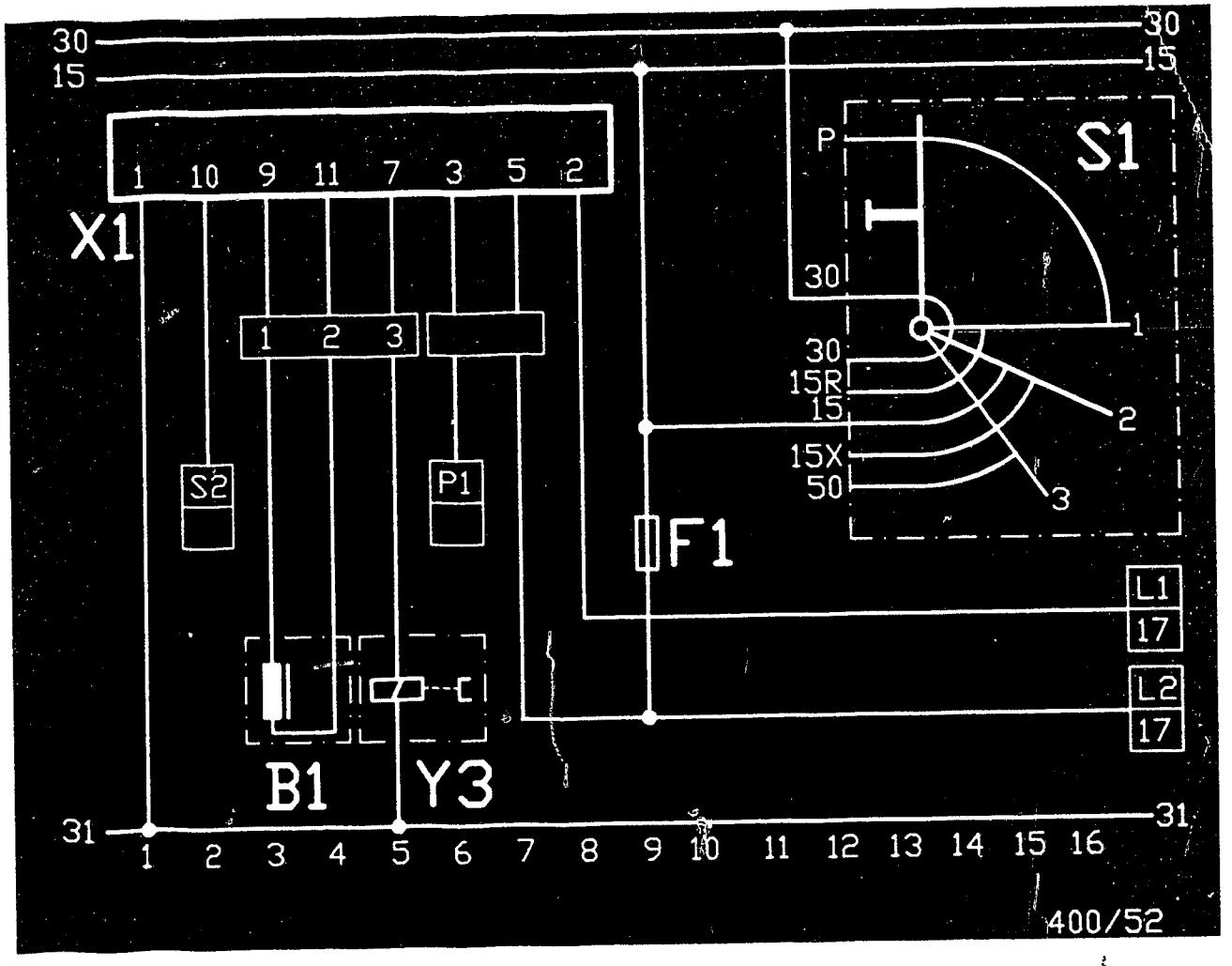
1 = Engine-speed sensor
2 = Temperature sensor (engine)
3 = Trimming plug
4 = Control unit
5 = Servo magnet for idle speed
6 = Servo magnet for active bucking damping
A = Measuring outputs

COMPONENTS OF THE ACTIVE BUCKING DAMPING (ARD)



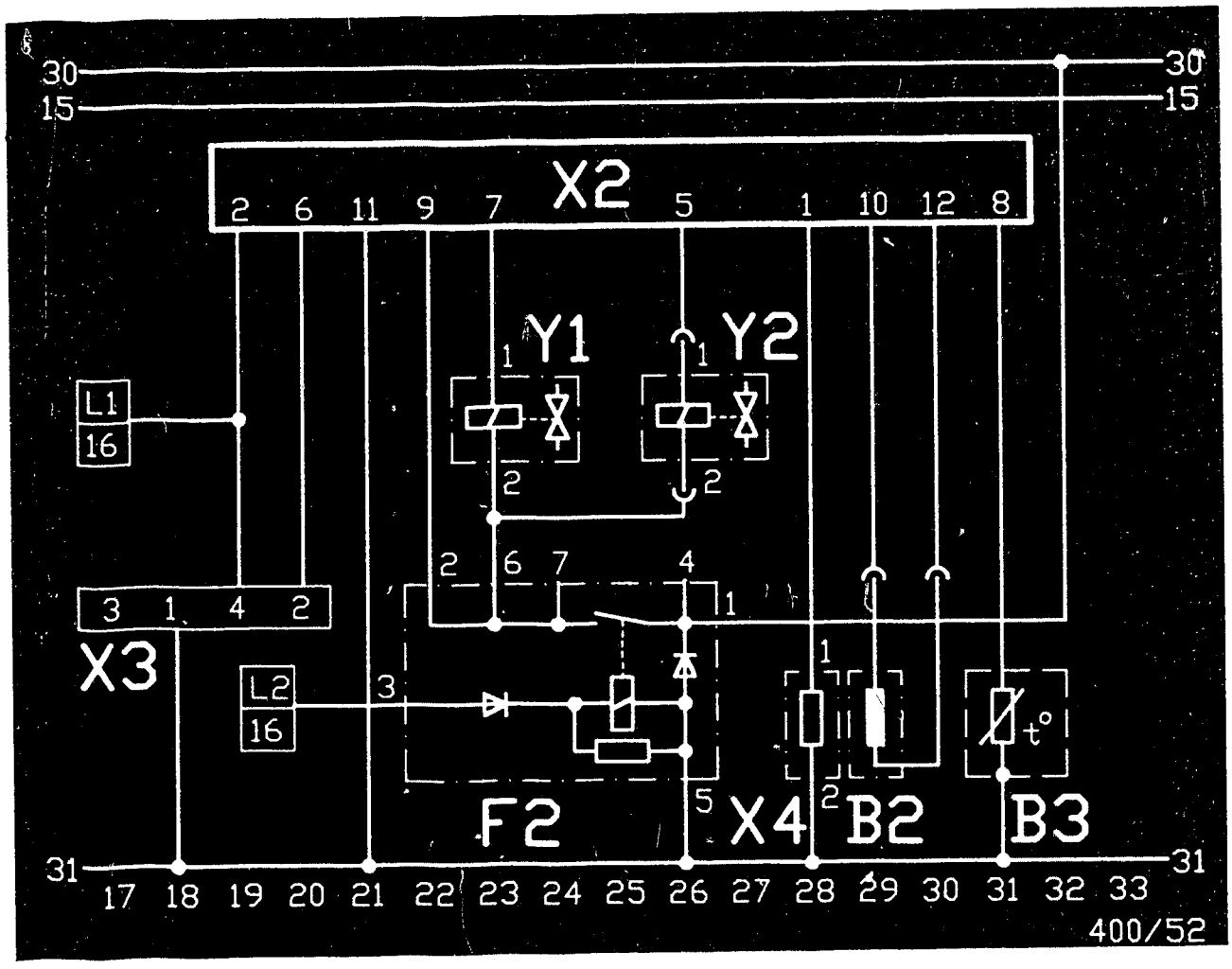
1 = Adjusting bolt
2 = Control magnet
3 = Drive hub
4 = Sliding bolt
5 = Spring retainer

FEATURES OF THE ACTIVE BUCKING DAMPING



B1/Y3 = Refrigerant compressor
B2 = Engine-speed sensor
B3 = Temperature sensor (engine)
F2 = Overvoltage protection
P1 = Tachometer
S1 = Glow-plug and starter switch
S2 = Pressure switch, refrigerant compressor
X1 = Control unit, refrigerant-compressor cutoff
X2 = Control unit (ARD/ELR)
X3 = Test coupling
X4 = Single trimming plug
Y1 = Servo magnet (ELR)
Y2 = Servo magnet (ARD)

ELECTRICAL TERMINAL DIAGRAM
(Type 124 with automatic air conditioner)

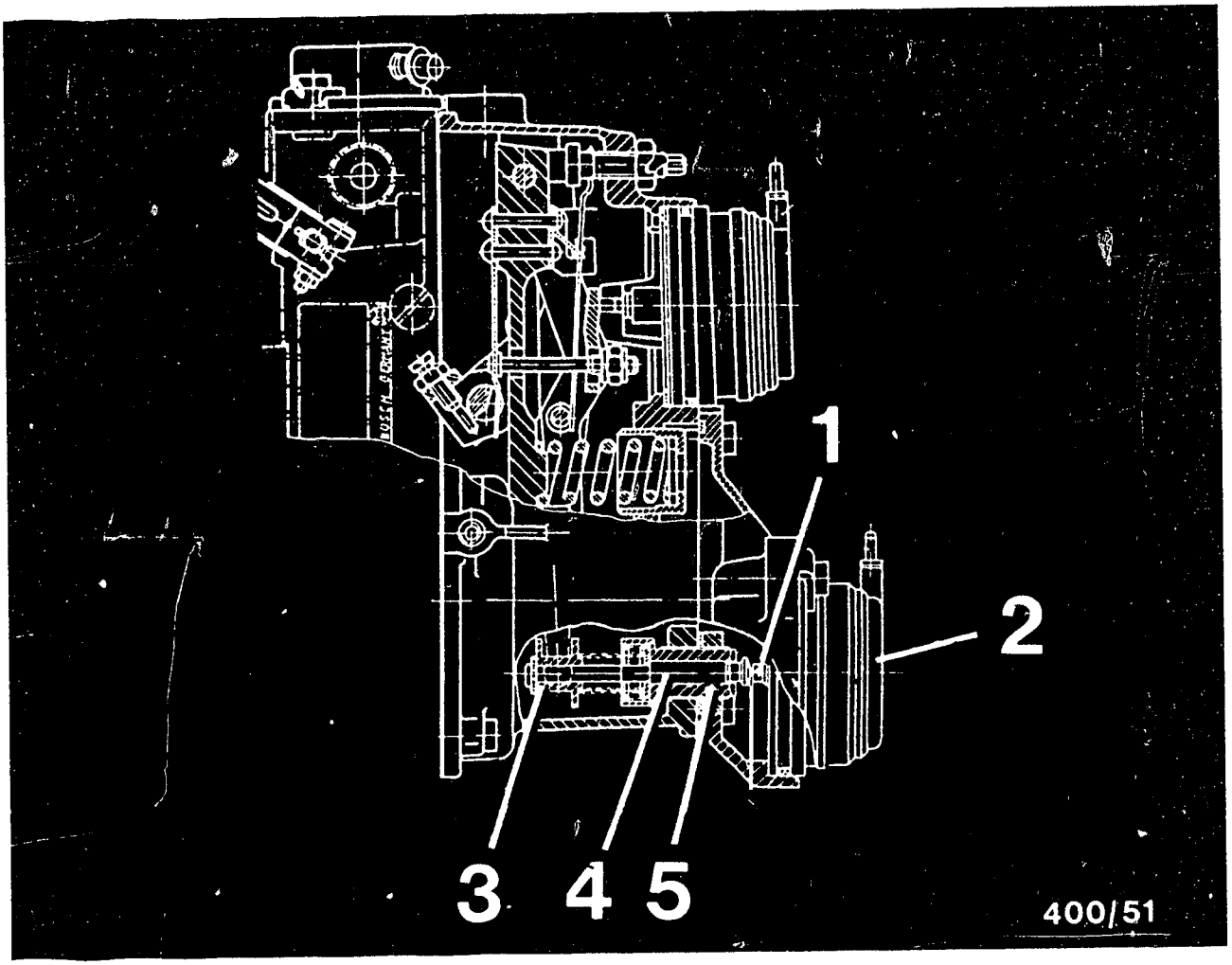


Operating principle of the active bucking damping (ARD)

The engine-speed sensor measures the engine speed (144 pulses/rotation) and passes this speed to the control unit in the form of an AC voltage.

By evaluating the engine-speed signal, a switching signal for damping the bucking vibration is output to the ARD servo magnets when there are fluctuations in the engine speed or cyclic irregularities.

If the increase in engine speed exceeds a specified upper limit, the servo magnet is activated.



4 = Sliding bolt

5 = Spring retainer

In this way, the sliding bolt presses on the spring retainer and the quantity of fuel injected is reduced by a fixed amount and the bucking vibrations limited to an uncritical value.

In order to achieve a sufficient level of damping during the load change when entering overrun (zero delivery), a mechanical closing damper reduces the level of "overrun bucking".

In addition, the sensitivity of the control function may be influenced in certain operating conditions by means of a trimming plug (not installed as standard).

Operating principle of the system – Self-diagnosis

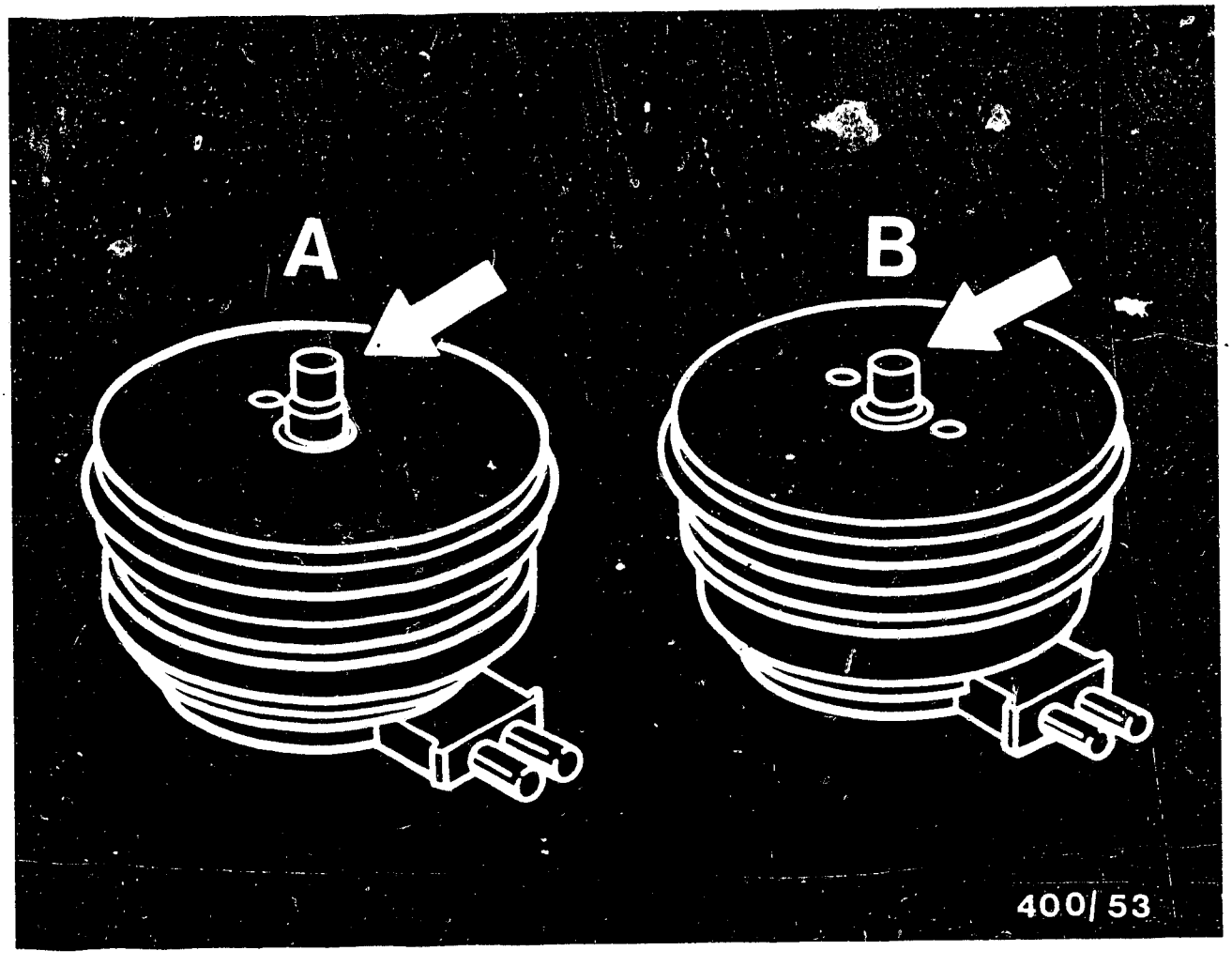
The control unit is equipped with a self-diagnosis facility in order to make it easier to detect faults.

In the case of system failures, pulse sequences dependent upon the cause of trouble are output after activation of the diagnosis.

These pulse sequences can be interpreted using the evaluating unit for flash diagnosis KDAW 9980.

Diagnosis indication:

Malfunction	Indication
System O.K.	1
Engine-speed sensor	2
Temperature sensor (engine)	3
Control circuit (ARD)	5
Control circuit (ELR)	6



Distinguishing features between ARD and ELR servo magnets

A = ELR servo magnet (red): integral sliding bolt (i.e. not separately exchangeable).
B = ARD servo magnet (black or gray): loose sliding bolt (i.e. separately exchangeable).

Published by:
Robert Bosch GmbH Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)
Please direct questions and comments
concerning the contents to our authorized
representative in your country.

Brief description of the system

The Mono-Jetronic system is an electronically controlled low-pressure fuel-injection system which operates without an air-flow sensor.
A lambda sensor and microcomputer control unit are used to

control fuel induction in the throttle-body injection unit in accordance with the residual oxygen content in the exhaust gas (lambda = 1).

Mono-Jetronic can therefore only be used in countries with unleaded fuel.

Users

The first vehicle manufacturer to use Mono-Jetronic is Fiat, equipping the Regata, Strada, Panda und Uno vehicles.
Start of series production 05.87 – 10.87.

Components

e.g.:	Throttle-body injection unit	0 438 201 ...
	Control unit	0 280 000 7..
	Lambda sensor	0 258 003 0..

Service/replacement parts

Repair-parts sets have been arranged for the throttle-body injection units (see service-part microcards EE... 0 438 201 ...).
See replacement catalog for replacement parts.

Test concept

Testing of the system in the vehicle is carried out with the universal test adapter in conjunction with a special adapter lead and a commercially available multimeter.

The tool KDJE 7463 is required to press in the injection valve.

Test equipment

Universal test adapter	ETT 018.01 Part no. 0 684 101 801
Adapter lead	Part no. 1 684 463 170
Pressure gauge	Part no. KDJE-P 100/17

Delivery by the usual means (technical equipment supplier BG, RG/AV).

Technical documentation

Trouble-shooting instructions and test specifications:
SIS microcard ... (see overview microcards KFZ 000/001).

System training

Integrated in the specialist courses and Jetronic Special.

Retrofitting

No provision is made for retrofitting of this system.

Warranty procedures

See warranty handbook.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Notes on the system

In contrast with the conventional diesel fuel-injection system with mechanically governed distributor-type fuel-injection pump (VE...F...), the electronically controlled diesel fuel-injection system (EDC = Electronic Diesel Control) has a distributor-type fuel-injection pump with electrical actuator (VE...E...).

Outwardly the VE pump of the EDC system is distinguished by the absence of the control lever on the housing cover in place of which a wiring-harness plug is fitted.

Further information can be obtained from the System Information cards (see SIS microcard KFZ..., commercial vehicles/passenger cars (engine) diesel fuel-injection pumps).

Users

The following vehicle manufacturers offer their vehicles with EDC:

Peugeot 505 td – as of 01.87 in Austria and Switzerland

Citroen CX2500d – as of 01.87 in Austria and Switzerland

BMW 524 td – as of 03.87 in Austria
(national variant for Austria)

BMW 324 td – as of 09.87 in Europe

Test concept

In the initial phase, after-sales service is restricted to system testing on the vehicle. All EDC systems are equipped with a self-diagnosis facility.

At the simplest level, trouble-shooting on the vehicle is carried out by triggering a flashing code in the self-diagnosis, with the aid of which the after-sales service specialist is able to determine the defective current path. At the second level, trouble-shooting is continued by the after-sales service specialist in the defective current path with the aid of special test leads and a multimeter, and the fault is precisely localized.

If a complaint has been made which is not indicated by self-diagnosis, trouble-shooting is carried out with the aid of special trouble-shooting instructions (see SIS microcard KFZ...). The set values for system testing in such instances must always be taken from the vehicle-specific SIS brief instructions.

Initially no provision is made for testing of the electronically contolled injection pump on the pump tester. Distributor-type fuel-injection pumps which are recognized as being faulty within the warranty period must be returned and replaced by exchange pumps (see warranty handbook for address).

Repair

There is initially no provision for repair of the electronically controlled distributor-type fuel-injection pump.
The same applies to the nozzle-and-holder assembly with needle-motion sensor (NBF). Replacement of the nozzle in this holder with NBF is not permissible. It is only permissible to adjust the nozzle-opening pressure.
Nozzle-and-holder assemblies without NBF are dealt with in the familiar fashion.

Repair of the other components is either uneconomic or impossible (e.g. control units), which means that these must be replaced as the need arises.

Test equipment

Test adapter	KDEP 1165
Test leads	KDZS 0004 0005 KDUM 0007 0008
Multimeter	commercially available e.g. F l u k e 75 Multimeter

For other tools and test equipment see SIS microcard KFZ...

Technical documentation

Equipment	Microcard AP...
Service-parts list (for nozzle holder)	Mikrocard EP...
Trouble-shooting on vehicle	SIS Microcard KFZ...
Test specifications	in trouble-shooting instructions
Product specifications	Microcards KP..., KE...
Exchange	Exchange list
Product/application	Microcard GD...

Warranty procedures

Components about which a complaint has been made must be sent in during the warranty period with the warranty and goodwill application and delivery note KH/VKD3 – 15333 for warranty assessment.

Bosch Services in the Federal Republic of Germany should take the address for dispatch from the warranty handbook. Outside the Federal Republic of Germany defective components should be sent with the warranty and goodwill application to the national Bosch representative.

Published by:
ROBERT BOSCH GMBH Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

TIGHTENING TORQUES

Vehicle: Pass. car
04.1988

Brake disks / Wheels

0077 En

We would like to point out once again that tightening torques have a direct influence on braking behaviour. Brake disks or wheels which are tightened too tightly may be subject to distortion, the consequence being marked pulsation of the brake pedal and hence a loss of braking power.

Always pay attention to the specifications of the vehicle manufacturer when fitting wheels and brake discs.

Vehicle	Tightening torque (Nm)	
	Brake disk	Wheel bolt Wheel nut
ALFA-ROMEO		
Alfetta, Giulia, GT, Spider, 1750, 2000, 2600, Montreal	–	60... 80
Alfasud, Giuletta	–	65... 80
Giuletta 2.0, Alfa GTV	–	90...110
AUDI		
50, 80, 80 Coupe, 80 Quattro, 100, 200	–	110
BMW		
3, 5, 6, 7-series	–	90...110

Vehicle	Tightening torque (Nm)	
	Brake disk	Wheel bolt Wheel nut
CITROEN		
2 CV, Ami, Acadiane	–	40...60
Visa, LN	–	50...65
Visa II, GS, BX, ID, CX, SM	–	80...100
MERCEDES-BENZ		
Type 107, 114, 115, 116, 123, 126	V 115	100...110
Type 460 G Model	–	180
Type 208/307 Transp	–	160...180
FIAT		
Panda	–	75
Strada, Uno	–	86
131, 132, Argenta	–	100
FORD		
Granada, Capri II	40 – 47	70...90
Fiesta, Escort, Scorpio	42 – 47	70...100
Sierra	–	100
HONDA		
All models except	–	70...90
Prelude	–	100...120

Vehicle	Tightening torque (Nm)	
	Brake disk	Wheel bolt Wheel nut
LADA		
All models	–	60...70
LANCIA		
Gamma	–	66
Beta, A112	–	70
Delta	–	85
Thema	–	88
MAZDA		
All models	–	90...100
MITSUBISHI		
All models	–	70...80
NISSAN		
Sunny B11	–	80...100
OPEL		
Corsa, Kadett, Ascona, Manta, Rekord D/E, Commodore B/C, Senator, Monza	–	90
PEUGEOT		
104, 204, 205, 304, 305, 404, 504	–	60

Vehicle	Tightening torque (Nm)	
	Brake disk	Wheel bolt Wheel nut
PORSCHE		
924, 944	–	110
911, 912, 928	V 23 H 0.5	130
RENAULT		
R4, R5, R6	–	50...60
R14	–	60
R9, R12, R15, R16, R18, R20, R30	–	60...80
Alpine, Fuego	–	90
R25	65	100
SAAB		
All models	–	90...100
SEAT		
All models	–	88
SUBARU		
All models	–	90

Vehicle	Tightening torque (Nm)	
	Brake disk	Wheel bolt Wheel nut
TALBOT		
1307, 1308, 1309, 1510	55 Loc	55...75
Horizon	48 Loc	50...75
Murena	50	50...75
Tagora	50	80...90
TOYOTA		
Corolla	–	80...110
Tercel	–	90...110
Carina, Celica, Camry, Corana, Cressida, Crown	–	90...120
VOLVO		
66, 340, 343, 345, 360	–	80...90
242, 244, 245, 264, 265, 760	–	100...130
VW		
Beetle	–	130
Polo, Derby, Golf, Jetta, Scirocco, Caddy, Passat, Santana	–	110
Transporter	–	180
LT 28/31	–	F 320 R 200
LT 35/40/45	–	320

V = Front axle

H = Rear axle

Loc = Using Loctite

Use Loctite in accordance with the specifications of the vehicle manufacturer only.

The list shall be updated as soon as additional information is available from the vehicle manufacturers.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country

Environmental legislation in various countries requires that all those involved in the development, servicing and repair of motor vehicles should have thorough knowledge of all the problems relating to exhaust emissions. We should like to give you a brief overview of the current state of the art. Some of the systems described have already been installed for some time in passenger vehicles licensed in the USA, Japan and Canada or are about to be introduced there soon. For example:

AUDI:
Exhaust-gas recirculation and secondary air pump

BMW and PORSCHE:
Exhaust-gas recirculation, thermoreactor and secondary air pump.

MERCEDES-BENZ:
Exhaust-gas recirculation, oxidation catalyst and secondary air pump.

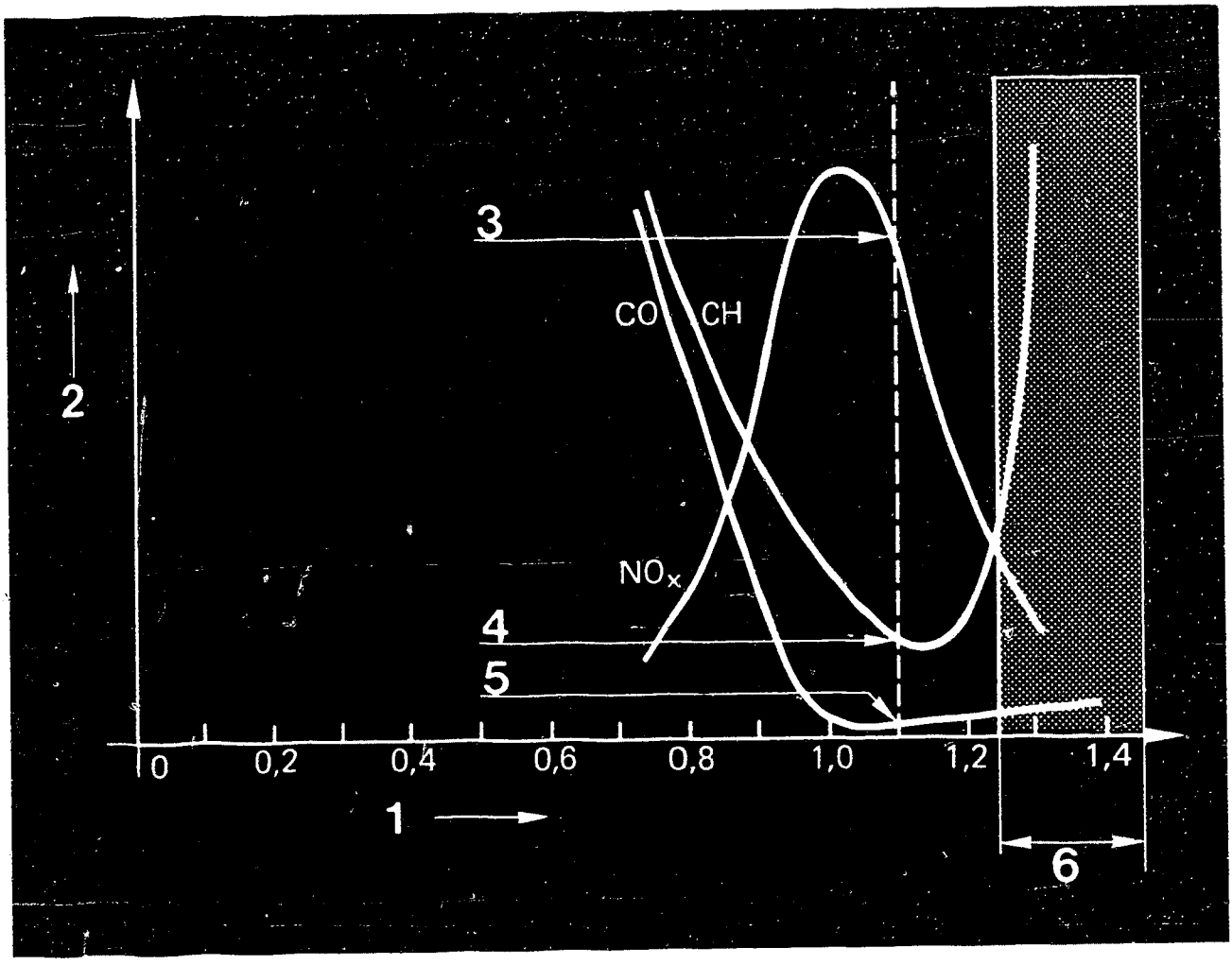
VW:
Exhaust-gas recirculation, hot pipe and secondary air pump

The expected more stringent exhaust-emission legislation will likewise necessitate the use of such units in Europe.

1. Exhaust-gas composition

The most important exhaust-gas constituents are as follows

* Carbon monoxide (CO): invisible, odorless, toxic.
* Hydrocarbons (HC): harmful, unpleasant odor, form other toxic products if exposed to sunlight.
* Nitrogen oxide (NOx): invisible, odorless, toxic, not discharged from the body again.



1 = Excess-air factor (lambda)
2 = CO, CH, NOx
3 = NOx max. value
4 = CH min. value
5 = CO min. value
6 = Lean-misfire-limit range

The above picture provides information on the exhaust-emission behavior of a spark-ignition engine. For the exhaust-gas constituents CO, HC and NOx it reveals an – in part – contrary profile as a function of the excess-air factor (lambda). The excess-air factor (lambda) results from the ratio of the amount of air supplied to the amount of air theoretically necessary for optimum combustion.

$$\text{Lambda} = \frac{\text{amount of air supplied}}{\text{theoretical air requirement}}$$

Lambda = 0.9 = rich mixture

Lambda = 1.1 = lean mixture

The most favorable lambda value for all pollutant components is to be found with lambda = 1.1.

2. How can the exhaust-gas composition be influenced?

2.1 Engine design

Combustion is improved by way of a combustion-promoting combustion-chamber design (piston shape, position of spark plug) and by achieving a good mixture swirl in the intake passage – the so-called swirl passage.

2.2 Mixture preparation

A better air/fuel mixture is achieved by way of intake-air preheating where the heat of the exhaust manifold is used to heat the air drawn in.

In overrun operation, adaptation is improved by using a vacuum limiter. This takes the form of a valve opening a bypass in parallel with the throttle valve. There is thus always sufficient ignitable mixture even under overrun conditions.

A similar effect is produced by a closing damper at the throttle valve. This unit delays closing of the throttle valve at the start of overrun operation. The damper is a pneumatic element with which the force of the throttle valve as it closes first has to press a volume of air out of a bellows. With this system it is not, however, possible to maintain a precisely defined vacuum and the break-off of combustion in lengthy overrun operation is not prevented.

2.3 Fuel-injection system

Fuel-injection systems make it possible to correct the mixture composition in a number of ways. Reference is made here to the following publications: K-Jetronic, VDT-U 3/1, D-Jetronic VDT-UBE 761/1 and L-Jetronic VDT-U 3/3. Jetronic systems currently make for better mixture adjustment.

2.4 Mixture adjustment

Exhaust emissions can be considerably reduced by way of a lean mixture adjustment. It should be noted that too lean a mixture greatly reduces engine output, causes rough engine running and leads to an increase in the HC emission level due to individual instances of misfiring.

Fixed settings are laid down by law and by way of mixture adjustment using an exhaust-gas analyzer.

2.5 Ignition adjustment

The effectiveness of combustion is considerably influenced by the ignition point.
Advanced ignition produces a high torque and favorable consumption, but the formation of nitrous oxides is greatly promoted as a result of the high combustion-chamber temperatures. In view of the fact that with advanced ignition the combustion process is largely completed in the combustion chamber, the exhaust remains cool and the unburnt hydrocarbons (HC) are only subjected to slight afterburn.

Retarded ignition (vacuum retard by way of vacuum unit) makes for a reduction in combustion-chamber temperature and thus in the level of nitrogen oxide formation. The exhaust gases which are considerably hotter on leaving the combustion chamber heat up the exhaust to a greater extent and thus enable the hydrocarbons to be subjected to afterburn in the exhaust.

Investigations have shown what happens to the exhaust-gas values if the ignition point is too far advanced or too retarded. 6° excessive advance, for example, increases the hydrocarbon level by more than 25 % and the nitrogen oxide level by between 20 and 30 %. The following figures are designed to demonstrate that an incorrect ignition setting can also have an effect on the performance and service life of an engine.

The piston temperature increases, for example, from 300° to 400° C. This results in burnt-out valves, piston seizure, material torsion and reduced material strength.

The prescribed ignition settings must therefore always be complied with.

3. Exhaust-system measures

3.1 Thermal afterburn (oxidation)

Use is made for this purpose of a thermoreactor or the so-called hot pipe, an insulated exhaust system.

In both cases these units become particularly hot so as to ensure that the CO and HC exhaust components can be burnt along with the residual oxygen in the exhaust gas.

The inside of the thermoreactor is heated by the exhaust gases. Following the reaction, the exhaust gases flow through the outer jacket and thus form an external insulating layer. The thermoreactor is a sheet-steel construction which is flanged directly to the cylinder head and must be capable of withstanding temperatures between 800° and 1000° C.

The "hot pipe" is a simplified thermoreactor. It consists of a normal exhaust manifold surrounded by insulating material. The afterburn is not as effective, since the dwell time of the exhaust gases in this hot pipe is considerably shorter than is the case with the thermoreactor. If the residual oxygen contained in the exhaust gas is not sufficient to induce afterburn, air is additionally blown in at all exhaust valves by way of a secondary air pump. Loss of engine power must be accepted since this air pump is driven by the engine.

3.2 Catalytic afterburn

Purification of exhaust gas by subjecting the exhaust-gas constituents to chemical change.
All catalysts consist of a sheet-metal housing which is filled either with granular material or with a lattice-type/honeycomb-type element. The surface of the material is coated with the catalytic mass which primarily consists of various precious metals and is not itself subject to change during afterburn. The material promotes combustion simply by way of its presence. The use of catalysts for after-burning is linked to the use of unleaded fuel.
The following catalysts are principally employed.

* Oxidation catalyst: burns CO and HC.
* Reduction and oxidation catalyst (two-bed catalyst): NOx is decomposed in the 1st stage with a deficiency of oxygen. CO and HC are burnt in the 2nd stage with air being supplied from a secondary air pump.
* Selective catalyst. This is a single-bed catalyst in which reduction and oxidation take place simultaneously. This requires compliance with a narrow air-fuel ratio and is effected by means of lambda-sensor control. (See the following publications: D- and L-Jetronic VDT-UBE 761/1 / VDT-4 3/3).

3.3 Exhaust-gas recirculation

Exhaust-gas recirculation is another way of reducing pollutant emissions. In this case a certain amount of exhaust gas is returned to the intake side from the exhaust, thus reducing the temperature and peak combustion pressure. Disadvantage: combustion is affected and therefore has a negative influence on engine running, power and consumption. The amount of exhaust gas is controlled by a pneumatic (or by an electrical) exhaust-gas-recirculation valve.
Currently in preparation is a detailed description of all exhaust-gas problems in the series "Bosch Technical Information".
Published by:
Robert Bosch GmbH
Division KH After-Sales Service Department
for Training and Technology (KH/VSK)
Please direct questions and comments concerning the contents to our authorized representative in your country.

AUDI 100 – 5 D

Vehicle: Pass. car
03.1988

Problems with starting motors

0082 En

The starting motor 0 001 362 070 (trade ..069) was installed in the Audi 100 – 5 D up tp September/October 1979.

There have been cases of the solenoid switch of this starting motor failing due to contact oxidation at the terminal stud 30. This fault makes itself apparent in that the starting motor meshes but does not crank.

As of September/October 1979 the Audi 100 – 5 D features the starting motor 0 001 362 078 (trade ..077).

This starting motor differs from its predecessor in that the solenoid switch has a silver contact at the terminal stud 30.

Should the starting motor 0 001 362 070 (..069) fail as a result of the damage described, the solenoid switch is to be replaced by the solenoid switch 0 331 402 039 with silver contact and, at the same time, the starting motor is to be newly designated 0 001 362 078 (..077).

The starting motor 0 001 362 070 or ..069 will continue to be available for the VW-LT and the Volvo diesel.

Warranty procedure

This damage is vehicle-specific.
Warranty claims vis-a-vis Bosch can therefore not be entertained.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS

Vehicle: Pass. car
03.1988

e.g. ignition systems, Jetronic, Motronic, ABS

0084 En

Please ensure without fail that this Bulletin is passed on to your employees for their attention.
We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of examination carried out by the Ignition System Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Cenral Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co., of Berlin, a manufacturer of heart pacemakers. The results of the investigation were published in Issue 5/1980 of the journal "Biomedizinische Technik".

The most important findings relating to practice can be summarized from the examination report as follows.

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.

2. With a stationary engine and the ignition switched off, the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.

3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can in such cases be affected under certain conditions (voltage, current and frequency).
Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.

4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to their cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture such as the Anti-Lock Braking System (ABS), Jetronic, or Motronic because even the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department
for Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.
(Issued by: K1/VSA)

POWER-OUTPUT MEASUREMENT FOR VEHICLES WITH FOUR-WHEEL DRIVE

Vehicle: Pass. car
03.1988

0086 En

Standard workshop roller-type test stands (e.g. LPS 002) can only be used to measure the engine output of vehicles with 4-wheel drive if:

1. The drive train can be interrupted between front wheel and rear-wheel drive.

2. The 4-wheel drive can be disconnected.

The vehicle is never to be jacked up.

Particular attention is to be paid to the owner's manual and/or additional technical information from the motor-vehicle manufacturer.

It is not possible to test any other vehicles with 4-wheel drive, e.g. Golf Syncro, Mercedes-Benz 4-matic, BMW 325i X.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

NEW DATE OF MANUFACTURE AS OF 1980
FOR BOSCH PRODUCTS

Vehicle: Pass. car
03.1988

0094 En

The month codes relating to the date of manufacture (FD) of Bosch products always change every 10 years.

The month codes 41 – 52 were used for January to December in the period 1980 – 1989.
Some products are only marked with quarterly codes (e.g. spark plugs and nozzles). Since the third quarter of 1978 the FD (date of manufacture) of the second month of the respective quarter has been used as the quarterly code.

As regards the 3-digit FD (date of manufacture), the month codes are preceded by the year codes, with the result that the dates of manufacture are as follows for Bosch products as of 1980 (as an aid to recall, we have also indicated the date of manufacture for 1979):

	(1979)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
January	921	041	141	241	341	441	541	641	741	841	941
February	922	042	142	242	342	442	542	642	742	842	942
March	923	043	143	243	343	443	543	643	743	843	943
April	924	044	144	244	344	444	544	644	744	844	944
May	925	045	145	245	345	445	545	645	745	845	945
June	926	046	146	246	346	446	546	646	746	846	946
July	927	047	147	247	347	447	547	647	747	847	947
August	928	048	148	248	348	448	548	648	748	848	948
September	929	049	149	249	349	449	549	649	749	849	949
October	930	050	150	250	350	450	550	650	750	850	950
November	931	051	151	251	351	451	551	651	751	851	951
December	932	052	152	252	352	452	552	652	752	852	952

Please quote the exact dates of manufacture of defective products on all warranty claims, since this data is extremely important for quality control purposes.

Published by:
ROBERT BOSCH GMBH Division KH Technical After-Sales Service (KH/VKD 2) – After-Sales Warranty (KH/VKD3)
Please direct questions and comments concerning the contents to our authorized representative in your country.

PROBLEMS WITH FUEL QUALITY

Vehicle: Pass. car
03.1988

Effects on the driving behavior of
vehicles with spark-ignition engines

0092 En

Grades of fuel which do not comply with the DIN Standards 51 600 for leaded fuels and 51 607 for unleaded fuels may have a negative effect on the starting behavior and performance of vehicles with fuel-injection and carburetor engines. (Prerequisite: ignition, fuel induction and engine mechanics O.K.).

Vehicle trouble	Possible cause
Hot-starting problems (see also PKW-038/A08)	Formation of vapor bubbles in fuel due to excessive proportion of highly volatile additives (e.g. methanol)
Cold-starting problems	Inadequate vapor pressure with winter fuel.
Warm-up problems Poor acceleration with cold engine	Deposits on intake valves caused by fuel residues and/or carbon residue
Engine-oil dilution, increased engine wear	Formation of residue in combustion chamber caused by components with a high boiling point; frequent short-distance travel
Icing-up of carburetor	Excessive proportion of components with low boiling point, no anti-icing agent in fuel, intake-air preheating ineffective.

Vehicle trouble	Possible cause
Engine knocking	
– on acceleration	RON (1) of fuel too low
– at high speed	MON (2) of fuel too low
– increased consumption	fuel density too low, lower calorific value

(1) = RON = Research Octane Number

(2) = MON = Motor Octane Number

Further information on fuels and their properties is given in the BOSCH "Automotive Handbook".

Published by:

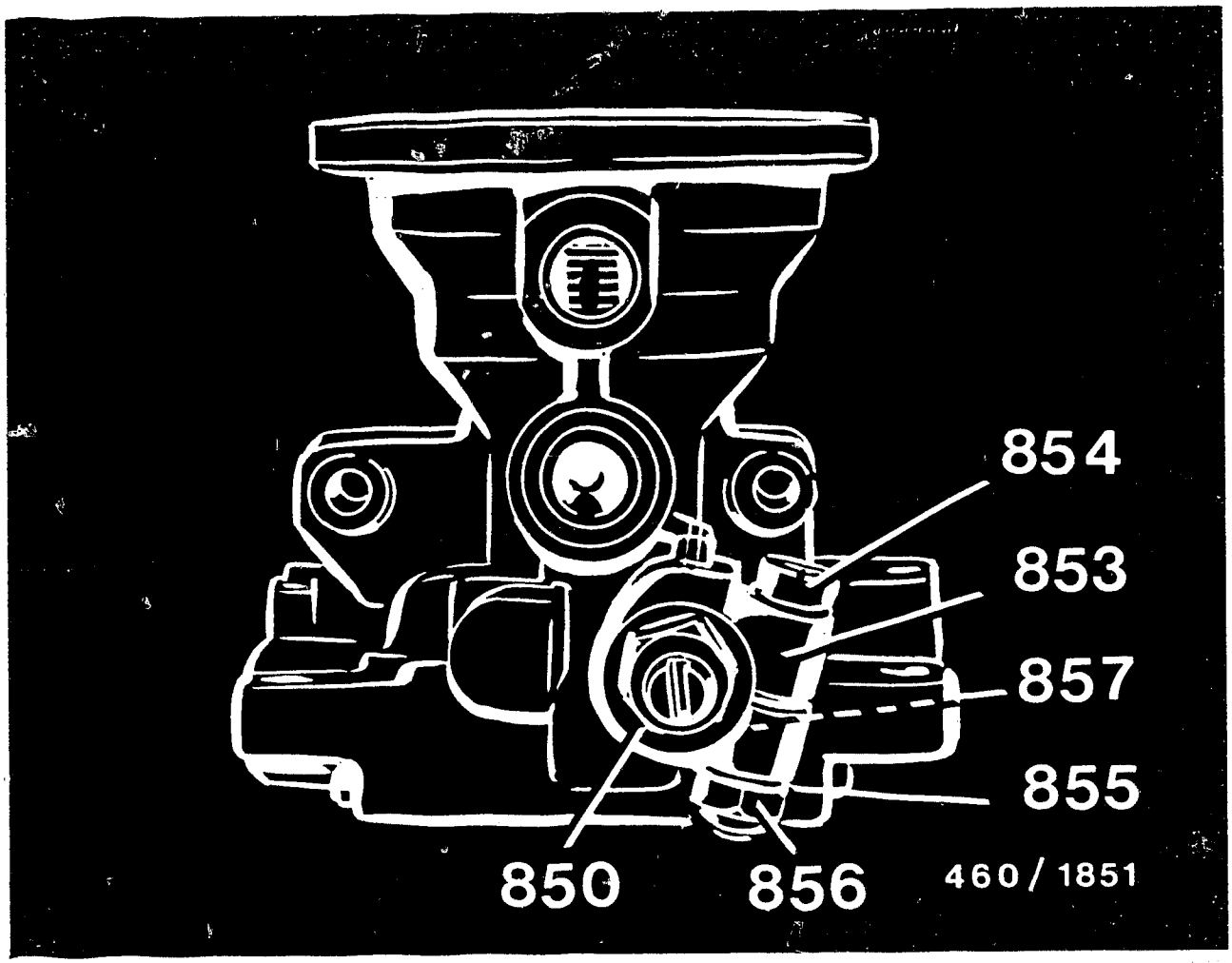
ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

BMW 324 d with VE 6/10F 2300 R206 – 0 460 406 047 Vehicle: Pass. car
06.1988

Technical modification:
Part number retained 0088 En

As of date of manufacture FD 742 (2.87) the above-mentioned distributor-type fuel-injection pump was modified whilst retaining the part no. 0 460 406 047. Distributor-type fuel-injection pumps up to FD 741 (1.87) and as of FD 742 (2.87) are not interchangeable. Apart from the date of manufacture, the ext. charac. feature of the new dist.-type fuel-inj. pumps is that there is no ext. charac. full-load adjuster (see illustr.).



The various versions are indicated on the latest service-parts list with the service parts for the full-load adjuster being listed under the item numbers given in the illustration.

The test code for distributor-type fuel-injection pumps up to date of manufacture FD 741 (1.87) is given on the following pages in this service information.

The test code for distributor-type fuel-injection pumps as of FD 742 (2.87) can be found on the test-specification microcards WP.. The FD is indicated at the start of the test-specification sheet.

Only the latest distributor-type fuel-inj. pumps (as of FD 742) will be delivered for replacement purposes (index 090).

When replacing a distributor-type fuel-inj. pump with date of manufacture FD up to 741, flat-type pintle nozzles 0 430 250 148 (DN 0 SD 286) with an opening pressure of p ö = 130 bar have to be fitted, since otherwise complaints may be received on account of constant bucking when driving.

BOSCH-FUEL-INJECTION-PUMP TEST SPECIFICATIONS

Pay attention to information given in remarks column!

Test-specification sheet	: BMW 2.4 E
Edition	: 19.12.86
Supersedes	: 10.85
Test oil	: ISO 4113
Fuel-injection pump	: VE 6/10F2300 R206
Type number	: 0 460 406 047
Customer-specific data:	
Customer	: BMW
Engine	: M21D24W

TEST-BENCH PREREQUISITES

Test-oil return temperature >°C	
with thermometer >	: 40...48
electronic >	: 42...50
Supply pressure bar	: 0.2

Calibrating noz.-hold. ass. >		: 1 688 901 022
Opening pressure > bar		: 130 ... 133
Test pressure line		: 1 680 750 073
Outer diameter		: 6
x wall thickness >		: 2
x length >	mm	: 450

Fuel-injection pump settings
Check values in parentheses

Timing-device travel:

Engine speed	1/min	: 1500
Charge-air press.	hPa	: 500
Setting	mm	: 4.1...4.5
KSB sol. valve >	volts	: —

Supply pump pressure

Engine speed	1/min	: 1500
Charge-air press.	hPa	: 500
Setting	mm	: 5.9...6.5
KSB sol. valve >	volts	: —

Full-load delivery without charge-air pressure:

Engine speed	1/min	: 1250
Fuel delivery >	cm3/ 1000 strokes	: 27.5...28.5
KSB sol. valve >	volts	: —
Scatter >	cm3/ 1000 strokes	: 3.5 : —

Idle speed regulation:

Engine speed	1/min	: 400
Charge-air press.	hPa	: 500
Fuel delivery >	cm3/ 1000 strokes	: 6.0...10.0
KSB sol.-valve >	volts	: —

Scatter	cm3/	: 3.5
>	1000 strokes	: ——

Full-load speed regulation:

Engine speed	1/min	: 2500
Charge-air pressure	hPa	: 500
Fuel delivery	cm3/	
>	1000 strokes	: 11.5...17.5
KSB solenoid valve >	volts	: ——
Scatter	cm3/	: 5.0
>	1000 strokes	: ——

Start:

Engine speed	1/min	: 100
Charge-air pressure	hPa	: ——
Fuel delivery	min.	
>	cm3/1000 str.	: 45.0
KSB solenoid valve >	volts	: ——
Scatter	cm3/	: ——
>	1000 strokes	: 12.0

Fuel-injection-pump test specifications
Check values in parentheses

Timing-device profile:

1st engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 3.0...4.0
>	mm	: (2.8...4.2)
KSB solenoid valve >	volts	: 12.0
2nd engine speed	1/min	: 1000
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 4.5...5.5
>	mm	: (4.3...5.7)
KSB solenoid valve	volts	: 12.0
3rd engine speed	1/min	: 750
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 0.8...1.6
>	mm	: (0.5...1.9)
KSB solenoid valve >	volts	: ——

4th engine speed	1/min	: 1500
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: —
>	mm	: (3.6...5.0)
KSB solenoid valve >	volts	: —
5th engine speed	1/min	: 2000
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 6.1...6.9
>	mm	: (5.8...7.2)

Supply-pump pressure profile:

1st engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
Supply pump pressure >	bar	: 3.1...3.7
KSB solenoid valve >	volts	: —
2nd engine speed	1/min	: 2000
Charge-air pressure	hPa	: 500
Supply pump pressure >	bar	: 7.2...7.8
KSB solenoid valve >	volts	: —

Overflow quantity at overflow valve:

1st engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
KSB solenoid valve >	volts	: —
Overflow quantity >	cm3/10	: (26...98)
2nd engine speed	1/min	: 2300
Charge-air pressure	hPa	: 500
KSB solenoid valve >	volts	: —
Overflow		: 55...138
quantity >	cm3/10	: (40...153)

Fuel-delivery and regulation characteristics:

1st engine speed	1/min	: 1250
Charge-air-press. adj. pt.>	hPa	: 120
LDA stroke	mm	: 5.0
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 23.2...26.7
	1000 strokes	: (22.7...27.3)
2nd engine speed	1/min	: 2650
Charge-air pressure	hPa	: 500
KSB solenoid valve >	volts	: —

Fuel delivery	cm3/	: ——
>	1000 strokes	: 0...6.0
3rd engine speed	1/min	: 2500
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: ——
>	1000 strokes	: (10.5...18.5)
4th engine speed	1/min	: 2300
Charge-air pressure	hPa	: 500
KSB solenoid valve	volts	: ——
Fuel delivery	cm3/	: 26.2...29.2
>	1000 strokes	: (25.4...30.0)
5th engine speed	1/min	: 1750
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: 28.8...32.2
>	1000 strokes	: (28.2...32.8)
6th engine speed	1/min	: 1250
Charge-air pressure	hPa	: -100
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: 22.0...24.0
>	1000 strokes	: (20.7...25.3)
7th engine speed	1/min	: 1250
Charge-air pressure	hPa	: 120
KSB solenoid valve	volts	: ——
Fuel delivery	cm3/	: 23.3...26.7
>	1000 strokes	: (22.7...27.3)
8th engine speed	1/min	: 1250
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fördermenge	cm3/	: ——
>	1000 strokes	: (25.7...30.3)
9th engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: 27.5...30.5
>	1000 strokes	: (26.0...32.0)
Zero delivery (stop):		
Mech. shutoff:		
Engine speed	1/min	: ——
Fuel delivery	cm3/	: ——
>	1000 strokes	

Electric shutoff:		
Engine speed	1/min	: 400
ELAB	volts	: —
Fuel delivery	cm3/	: —
>	1000 strokes	
Idle delivery:		
1st engine speed	1/min	: 400
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: (4.0...12.0)
2nd engine speed	1/min	: 450
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: 0...6.0
Automatic starting quantity:		
1st engine speed	1/min	: 200
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 42.0...52.0
min. >	1000 strokes	: —
2nd engine speed	1/min	: 400
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 25.0...35.0
max. >	1000 strokes	: —
3rd engine speed	1/min	: 480
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 21.7...26.3
>	1000 strokes	: —
Shutoff solenoid:		
Cut-in voltage min. >	volts	: 10.0
Rated voltage	volts	: 12.0

Installation and adjustment dimensions:

Designation		
K	mm	: 3.2...3.4
KF	mm	: 6.4...6.6
MS	mm	: 1.4...1.6
SVS max.	mm	: 3.9
XK	mm	: 17.0...19.0
XL	mm	: 9.6...13.0

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service Department (KH/VKD 2)

Please direct questions and comments
concerning the contents to our authorized
respresentative in your country

NEW SYSTEM

Vehicle: Pass. car
06.1988

LH 2.4 – Jetronic

0098 En

GENERAL

The LH 2.4 system version is a further development of the previous LH 2.2-Jetronic, which however it does not replace.

The system operates according to the same principle as the LH 2.2-Jetronic, but is distinguished by the following points:

* 35-pin control unit
* Closed-loop idle-speed control with single-winding rotary actuator (2-pin connector).
* Adaptive lambda closed-loop control
* Tank ventilation system
* Self-diagnosis

POSSIBLE SCOPE OF CONTROL-UNIT FUNCTIONS

Inputs	Functions	Outputs
Hot-wire air-mass flow sensor →	Basic functions of fuel injection	
Engine speed/trigger →	Starting control	Injection valves →
Temperature sensor(eng.) →	Additive characteristic-map adjustment	Fuel pump →
Ign./starting switch →	Adaptive precontrol	Idle actuator →
Supply voltage →	Lambda closed-loop control	Burn-off hot-wire air-mass flow sensor →
Lambda sensor →	Closed-loop idle-speed control	Load signal tq →
Idle switch →	Burn-off control	Consumption signal →
Full-load switch →	Load-signal processing	Tank ventilation valve →
Transmission or speed switch →	Gear-change calculation	Change-up indication →
Air-conditioning compressor →	Actuation of tank-ventilation valve	Cold-start valve, if coded →
Drive(automatic transm.) →	Consumption calculation	Diagnosis lamp/tester →
Coding - cold-start valve →	Overload protection	
Data encoding →	CARB * diagnosis	CARB * = California Air Research Bureau
tv encoding →		

Control-unit functions differing from LH 2.2 – Version

* Adaptive closed-loop idle-speed control

A new idle-speed control system is now used in conjunction with LH 2.4. A single-winding rotary actuator is used as the idle actuator.
Pulsating direct current is applied to the winding of the actuator by the control unit. At the rotating armature of the idle actuator this creates a torque which opposes the force of the return spring.
Changes to the on/off ratio result in alteration of the cross section of the rotary slider which determines the air quantity.
Various set speeds are stored in the control unit dependent on engine temperature.
In order to keep the adjustment to the rotary slider as small as possible, precontrol of the idle actuator is adjusted.

* Adaptive lambda closed-loop control

Precise precontrol (control value) of the lambda closed-loop control system is necessary in order to adhere precisely to the exhaust-emission values. The values stipulated by application are stored in the control unit. In the course of the life of the vehicle, however, changes may arise such as altitude faults and leakage air which require modification of the precontrol. This is carried out by the control unit and is known as adaptation of the precontrol to the lambda closed-loop control system.
The adaptive lambda closed-loop control system makes it unnecessary to set the CO content by way of the integrator voltage.

* Tank ventilation system

The fuel vapors from the fuel tank which are collected and condensed in the activated-carbon filter are fed into the intake tract of the engine via the tank-ventilation valve.
The valve is actuated by the control unit. The returned quantity of fuel is varied by the tank-ventilation valve as a function of load and engine speed in order to adapt to the lambda characteristic map.
Valve actuation is continuous at a fixed frequency and with a variable on/off ratio.

* Cold-start-valve encoding

Input at battery voltage: Cold start with cold-start valve

Input open: Cold start without cold-start valve

* System coding

Input to ground : No lambda closed-loop control (EU adaptation)

Input open : Lambda closed-loop control (basic adaptation).

* Fault lamp

This lamp indicates faults arising during driving operation which determines exhaust-gas composition, e.g. to the hot-wire air-mass flow sensor, lambda sensor and engine-temperature sensor.

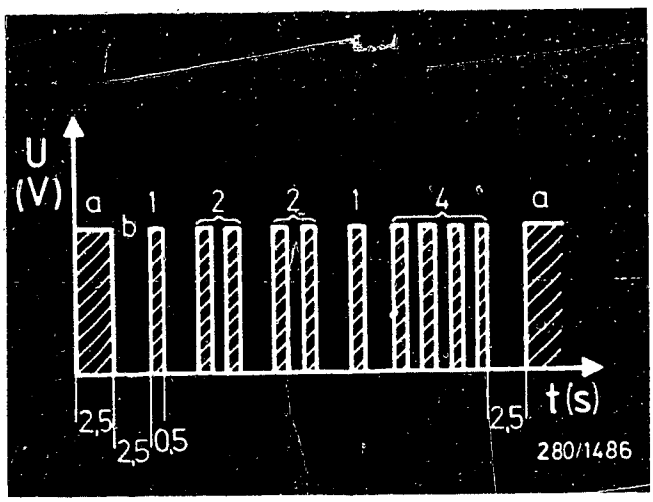
At the same time the lamp serves to output the flashing code for self-diagnosis.

* Self-diagnosis (for example)

Faults detected by the control unit are stored in the form of a fault code in chronological order of occurrence. The flashing code consists of 5 blocks each with a maximum of 9 flashing pulses.
The diagnosis lamp is located in the instrument panel.

Activation (stimulation) of self-diagnosis: connect control-unit terminal 16 to ground for approx. 2.5 s.

a = Start signal
(Diagnosis activation)
b = Interval before the first block



Presentation of fault code 12214 as an example

Note: Shaded field indicates fault lamp "ON".

When activation is repeated either another fault is output or, if there is none present, end of diagnosis indicated

End of diagnosis: Lamp flashes at a steady rhythm, 2,5 s on, 2,5 s off, until the ignition is switched off.

Flashing code – fault table (example):

Condition: Engine at operating temperature, idle speed.

Before activating diagnosis, run vehicle at least 5 minutes at engine speed min. 3000 min $^{-1}$. Do not switch off ignition following this.

Fault code	Fault area
12111	Adaption limits lambda closed-loop control (multiplicative)
12112	Adaption limits lambda closed-loop control (additive)
12113	Adaption limits idle-speed control
12114	Adaption limits idle-speed control
12211	Supply voltage (below 10 V or above 16 V)
12212	Idle switch
12213	Full-load switch
12214	Temperature sensor (engine)
12221	Hot-wire air-mass flow sensor
12222	Idle actuator
12223	Lambda sensor implausible (mixture too lean)
12224	Lambda sensor implausible (mixture too rich)
12225	Lambda sensor implausible (signal incorrect)
12231	No engine-speed signal
12232	Supply voltage term. 4 from control unit
12444	Fault memory empty/no fault
00000	End of diagnosis

Diagnosis of final controlling elements (example)

This concerns the final controlling elements electric fuel pump, injection valves, idle actuator, tank-ventilation valve, drive switch, air-conditioning switch, idle switch and full-load switch.

Initiation (stimulation) of final-controlling element diagnosis:

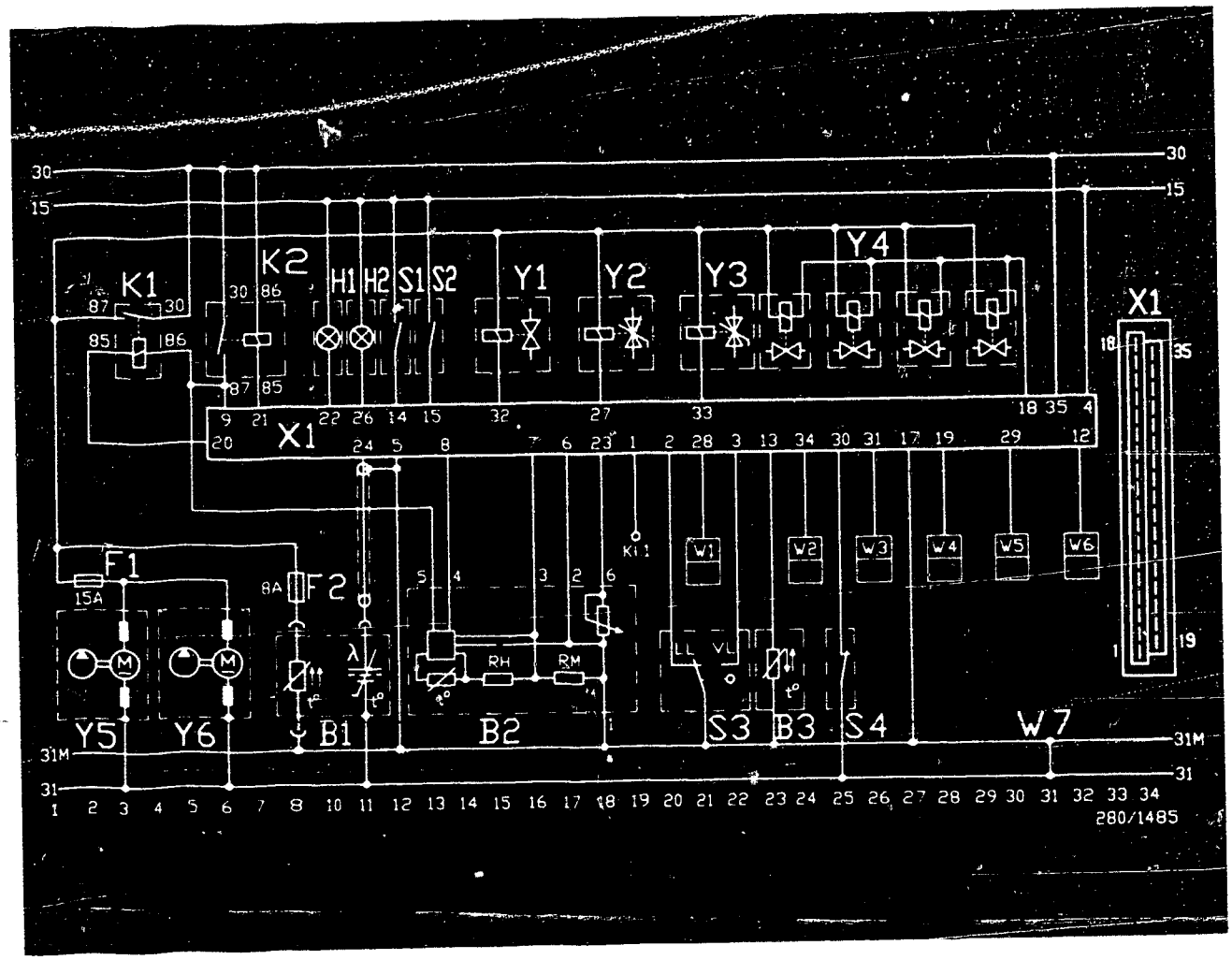
Before switching on ignition, connect term. 16 on control unit to ground. Remove connection again no sooner than 2.5 sec. after switching on the ignition.

The final controlling elements are actuated with the respective flashing code continuously until the next stimulus is received.

Actuation sequence:	Code number:
Electric fuel pump	–
Solenoid-op. inj. valves	12411
Idle actuator	12412
Tank-ventilation valve	12413
Drive (automatic)	12421
Air conditioning	12423
Idle switch	12424
Full-load switch	12431

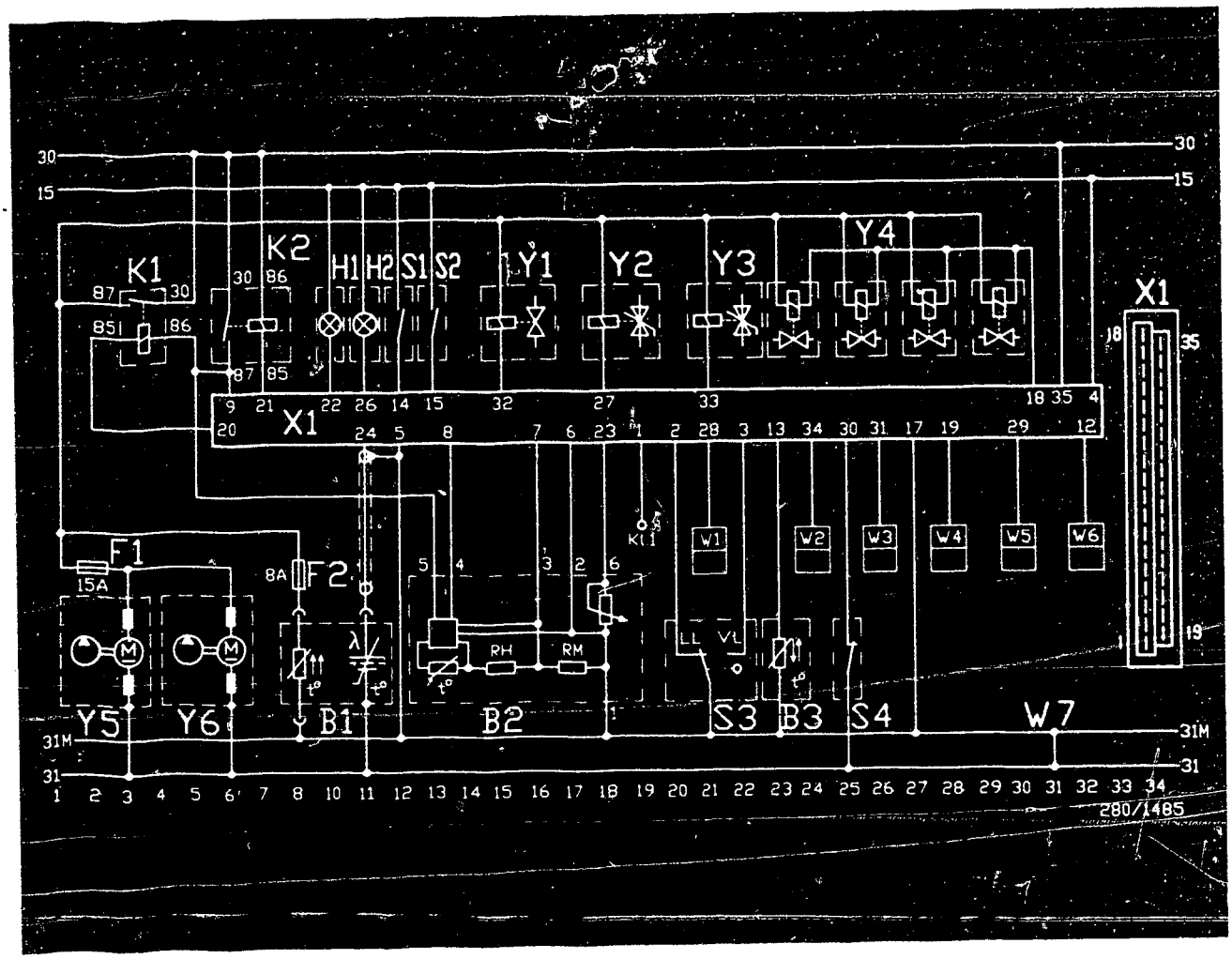
PIN ASSIGNMENT

Term.	Circuit	In-put	Out-put
1	Engine-speed signal (term. 1/TD)	X	
2	Idle switch	X	
3	Full-load switch	X	
4	Supply voltage (continuous positive)	X	
5	Electronics ground	X	
6	Sensor ground	X	
7	Sig. from hot-wire air-mass fl. sens.	X	
8	Burn-off signal		X
9	Supply voltage	X	
10	Not allocated		
11	Not allocated		
12	Diagnosis (K lead)	X	X
13	Temperature sensor (engine)	X	
14	Air-conditioning compressor	X	
15	Air-conditioning ready/strt.vlv.coding	X	
16	Diagnosis (stimulus lead)		
17	Lead ground	X	
18	Output stage, injection valve		X
19	Data coding/output stage, exhaust-gas recirculation	X	X
20	Pump relay		X
21	Main relay		X
22	Diagnosis indication		X
23	Additive characteristic-map correction / exhaust-gas recirculation		X
24	Lambda sensor	X	
25	Load signal (tq)		X
26	Shift indication/limp-home indication		X
27	Output stage, tank ventilation		X
28	System coding (lambda control)	X	
29	tv coding	X	
30	Drive (automatic)	X	
31	Consumption output		X
32	Gear switch (SAS)/start valve	X	X
33	Output stage, idle actuator		X
34	Road-speed signal /intake-manifold resonance flap	X	X
35	Voltage signal term. 15	X	



B1 = Heated lambda sensor
B2 = Hot-wire air-flow sensor
B3 = Temperature sensor (engine)
F1 = Pump fuse
F2 = Sensor-heater fuse
H1 = Diagnosis lamp
H2 = Shift indication/limp-home indication
K1 = Pump relay
K2 = Main relay
S1 = Air-conditioning compressor
S2 = Air-conditioning ready/cold-start-valve coding
S3 = Throttle-valve switch
S4 = Drive (in automatic)

ELECTRICAL TERMINAL DIAGRAM



W1 = System coding (lambda closed-loop control)
W2 = Road-speed signal
W3 = Consumption output
W4 = Data coding/exhaust-gas recirculation
W5 = tv coding
W6 = Diagnosis (K lead)
W7 = Engine ground strap
X1 = Control unit plug
Y1 = Gear switch (SAS)/cold-start valve
Y2 = Tank-ventilation valve
Y3 = Idle actuator
Y4 = Solenoid-operated injection valves
Y5 = Electric fuel pump
Y6 = In-tank pre-supply pump

ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

Service concept:

With regard to the mechanical and hydraulic system, the test technology is identical to that of other familiar fuel-injection systems.

Electrical / electronic testing can be begun in 2 ways:

a) Trouble-shooting by self-diagnosis if one or more faults are indicated. Specific correction of faults in the functional path determined as being defective with the aid of individual test leads.

b) Trouble-shooting according to trouble-shooting chart on the SIS microcard if no fault is indicated by self-diagnosis. Specific correction of faults in the functional path in accordance with trouble-shooting chart with the aid of individual test leads.

An adapter test lead for the universal test adapter is not available.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department
for Training and Technology (KH/VSK)

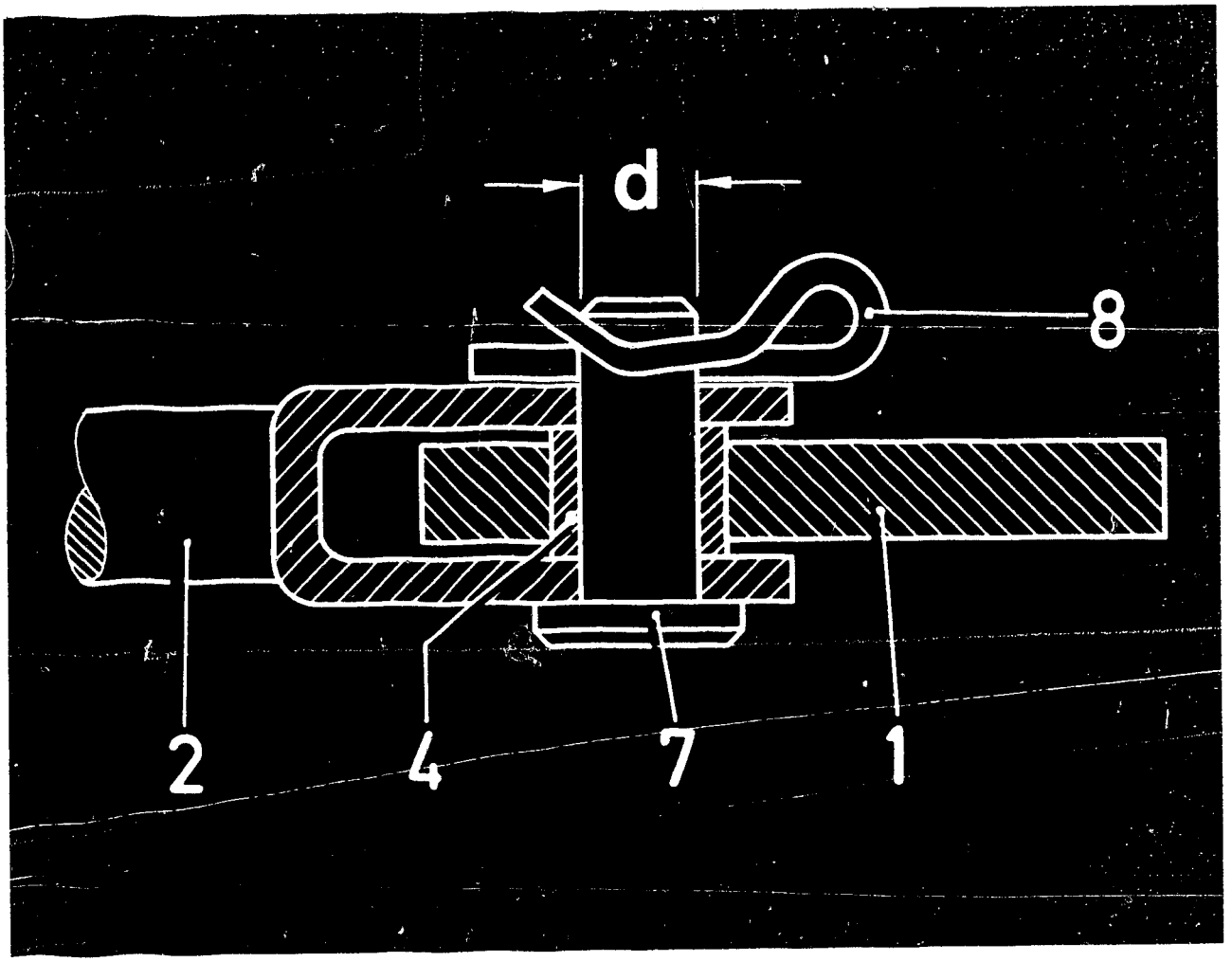
Please direct questions and comments concerning the contents to our authorized representative in your country

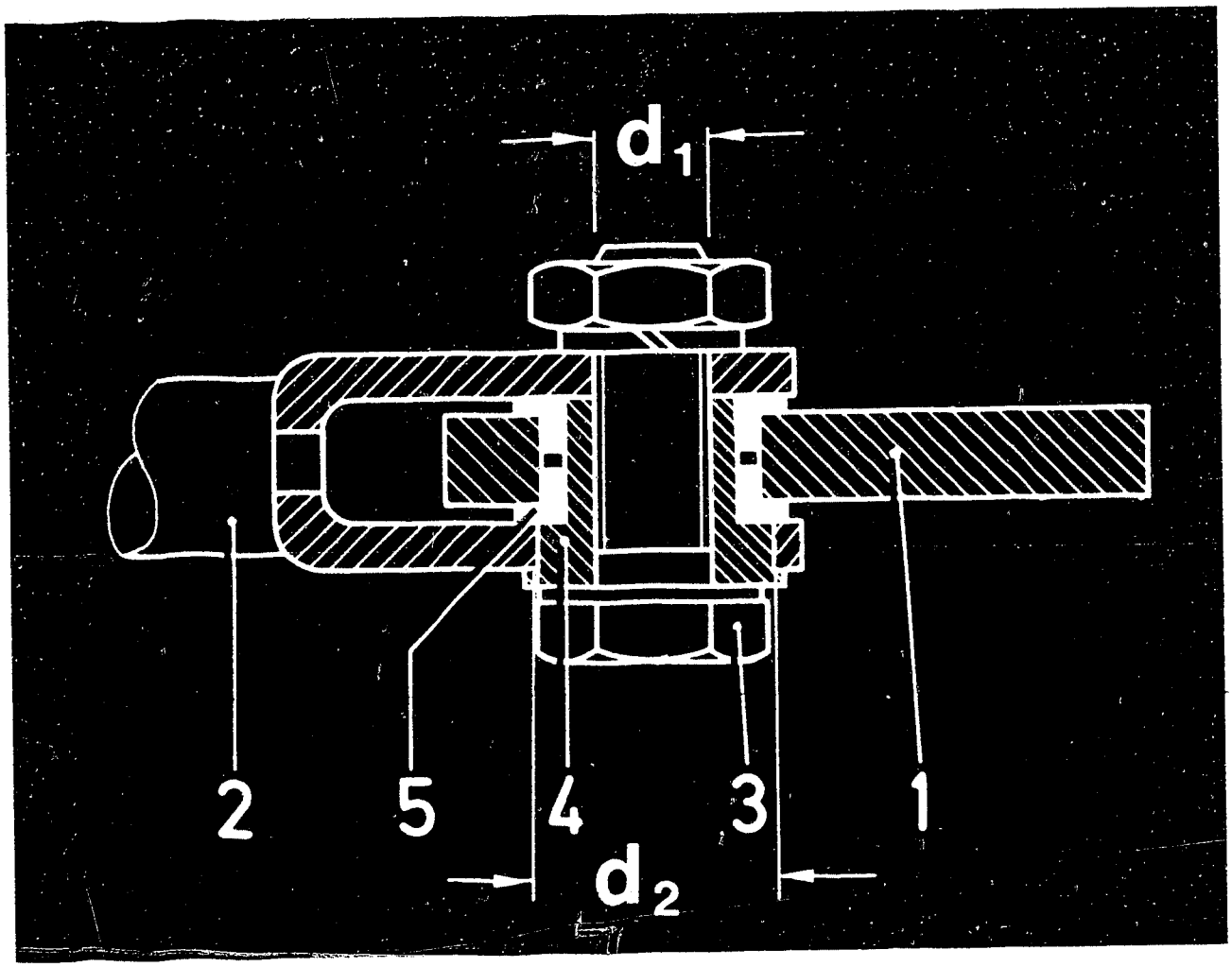
MERCEDES-BENZ 107, 116, 123 Series
Modification of attachment of brake pedal to brake booster

Vehicle: Pass. car
05.1988

0103 En

In the above vehicle series, as of September 1979 brake boosters were fitted in which the brake pedal was attached to the fork head of the push rod by means of a collar pin (item 7), bushing (item 4) and retainer (item 8).
In the new version, the holes in the fork head are of the same diameter (d).
The brake pedal (item 1) has a smaller hole.
1 = Brake pedal 2 = Push rod of brake booster

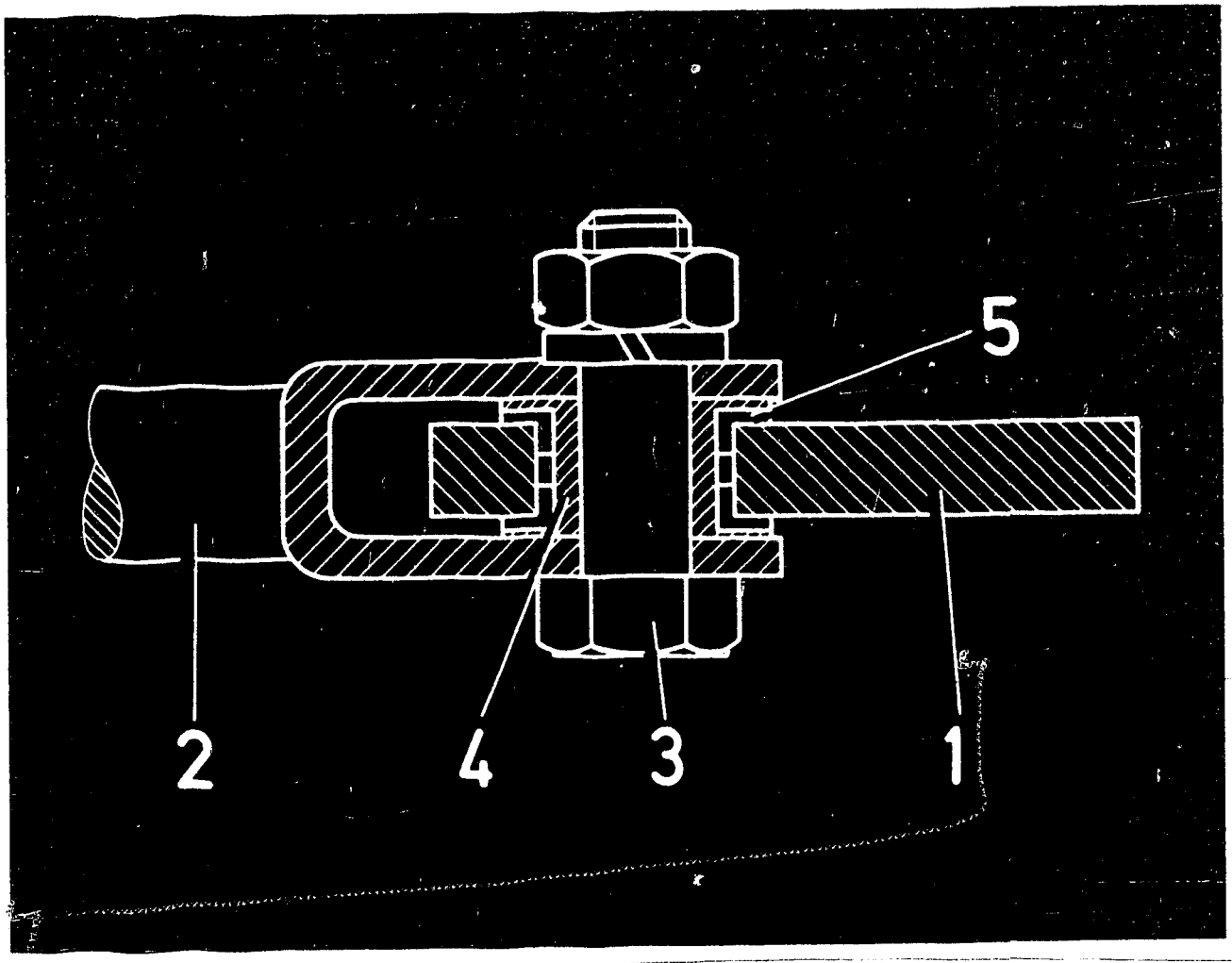




1 = Brake pedal
2 = Push rod of brake booster
3 = Hexagon bolt
4 = Bushing
5 = Bearing bushing

In the old version, the holes on the fork head are of different diameter (d 1 , d 2).

The upper illustration shows the old version with hexagon bolt and nut.

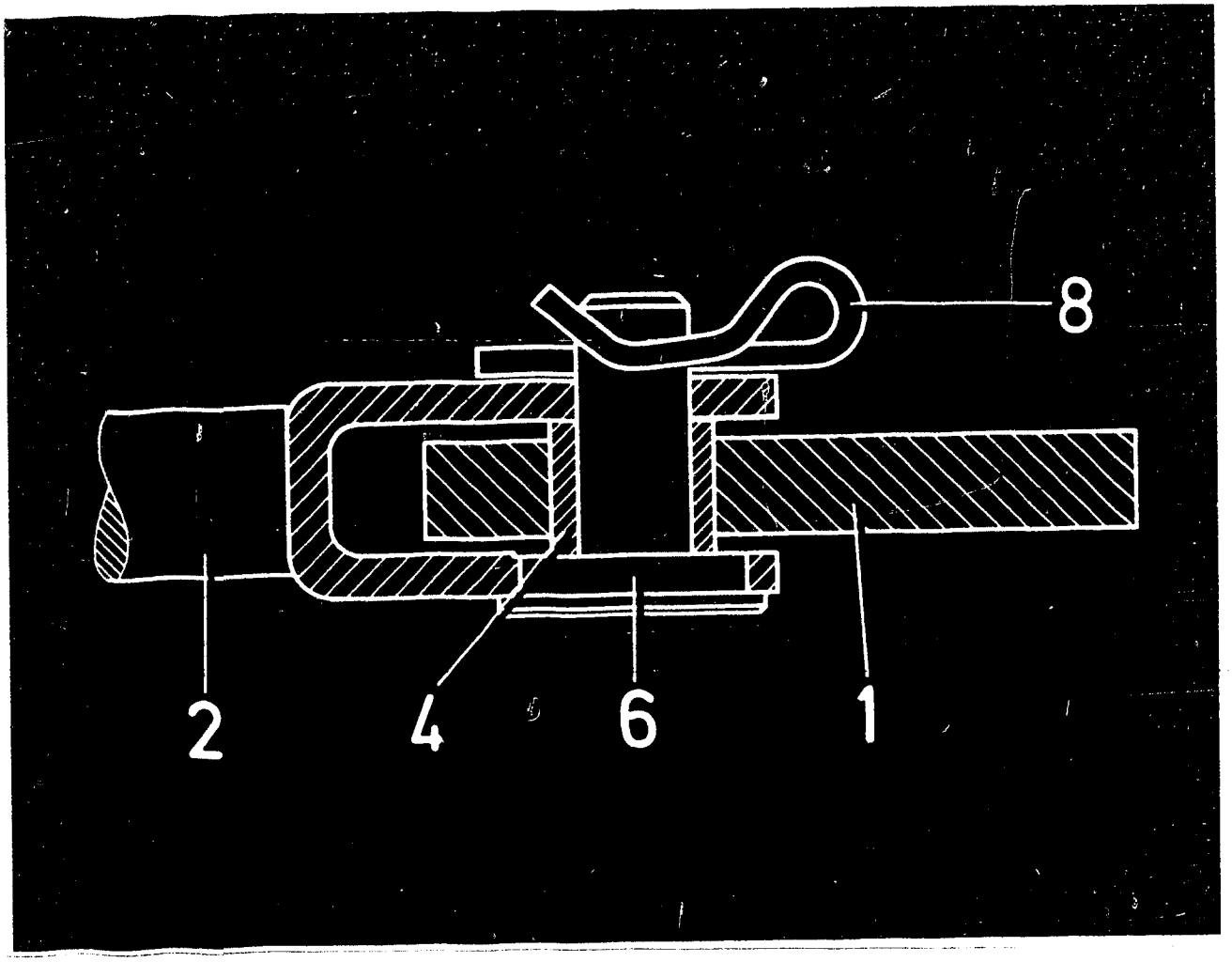


1 = Brake pedal
2 = Pushrod of brake booster
3 = Hexagon bolt
4 = Bushing
5 = Bearing bushing

Notes on repair:

1. If a brake booster is installed with modified fork head and an old brake pedal, the bushing in (upper illustration, item 4) must be used.

   Daimler-Benz replacement part no.:
   123 292 01 05 – bushing



1 = Brake pedal
2 = Pushrod of brake booster
4 = Bushing
6 = Stepped collar pin
8 = Retainer

2. If a modified brake pedal is fitted to a brake booster with an old-version fork head, the stepped collar pin (upper illustration, item 6) must be fitted including the retainer (item 8).

Daimler-Benz replacement part no.: 126 292 01 74 (stepped collar pin)
912 011 008000 (retainer)

The replacement parts required must be obtained from a vehicle dealership.

Published by: ROBERT BOSCH GMBH Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country

REPAIR BAN /
MAXIMUM PERMISSIBLE STORAGE TIME FOR
ABS AND ETC HYDRAULIC MODULATORS

Vehicle: Pass. car
06.1988

0105 En

1. Repair ban

Passenger-car ABS and passenger-car ABS with ETC (electronic traction control) are safety devices.
Unauthorized tampering with the ABS and ETC components involves the risk of interfering with the correct functioning of the ABS or ABS/ETC system.

We must therefore point out the fact that the hydraulic modulators must under no circumstances be repaired but for safety reasons must always be replaced as complete units.

It is permissible to replace only the motor relay and valve relay on the ABS hydraulic modulator.
All other bolts and plugs on the hydraulic modulators must n o t be released.

2. Maximum permissible storage time

The maximum permissible storage time for hydraulic modulators is 5 years calculated from the date of manufacture (FD) specified on the product.

The following storage conditions must be fulfilled:

* Hydraulic modulator filled with brake fluid (delivered from Bosch in the full condition).
* Vertical / upright position / attitude (cover at the top
* Ambient temperature between -20° C and +50° C.
* Store in a dry place.

Following a storage time of 5 years, all rubber and plastic parts must be replaced and the hydraulic modulator must be subjected to a functional test.

Replacement of the rubber and plastic parts, and the functional test, can only be conducted in the supplier factory. The tested hydraulic modulators are marked with a letter L in the repair designation and a new date of manufacture (FD)

* After-sales service workshops should send the hydraulic modulators via the authorized BOSCH national representative.

to:

Robert Bosch GmbH
KH/LAV 2 – Auspackraum z.W. an K1/VAK 2
Auf der Breit 4
7500 Karlsruhe 41
G E R M A N Y

It must always be ensured that all ends of pipes are sealed by plugs.

The hydraulic modulators must be sent in at no cost to Bosch. On the enclosed delivery note please make reference to this Technical Bulletin.

Exchange of the parts and the functional test are not carried out free of charge.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

BRAKE HOSE

Motor vehicle: Pass. car
07.1988

Maintenance and installation instructions

0113 En

1. Maintenance instructions

Brake hoses are exposed to extreme stress and should therefore be subjected not only to a visual inspection but also to a high-pressure test whenever inspections or brake repairs are performed.

Performance of a high-pressure test is described in the Service Information "Functional tests" (KFZ 000 car brakes)

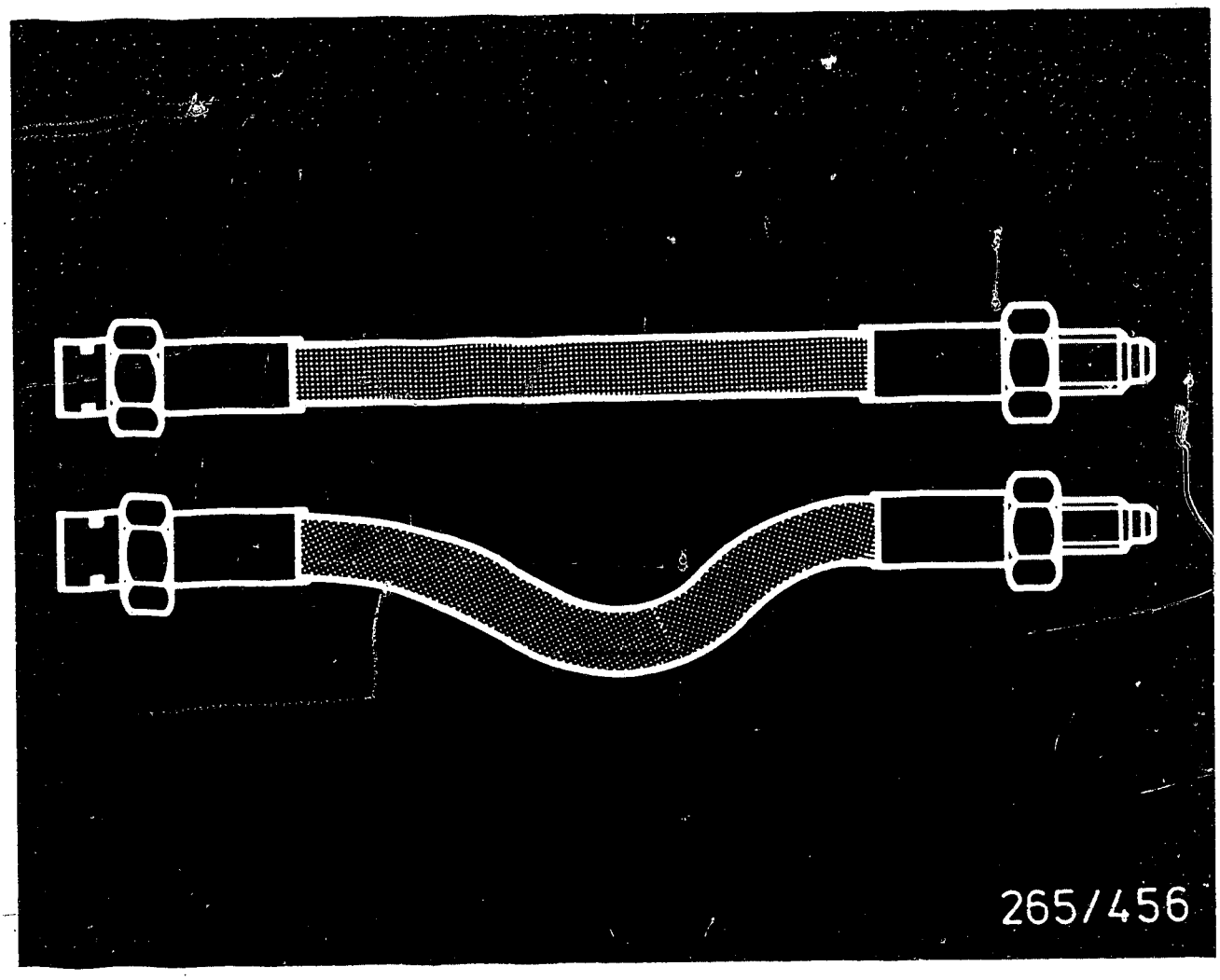
The required functions must be provided without any restrictions over the entire service life within broad temperature and pressure ranges.

Ambient temperature	:	- 40° C ... + 100° C
Max. operating press.	:	120 bar
Pressure peaks	:	upto 180 bar

Brake hoses are installed in their as-delivered condition and must neither be varnished nor covered with underbody sealant.

Brake hoses must not be cleaned using cleaning agents which contain mineral oil.
Dirt should be washed off with water.
When spraying the underside of a vehicle, the brake hoses are to be covered, as otherwise sprays containing mineral oil may cause decomposition of the brake hose.

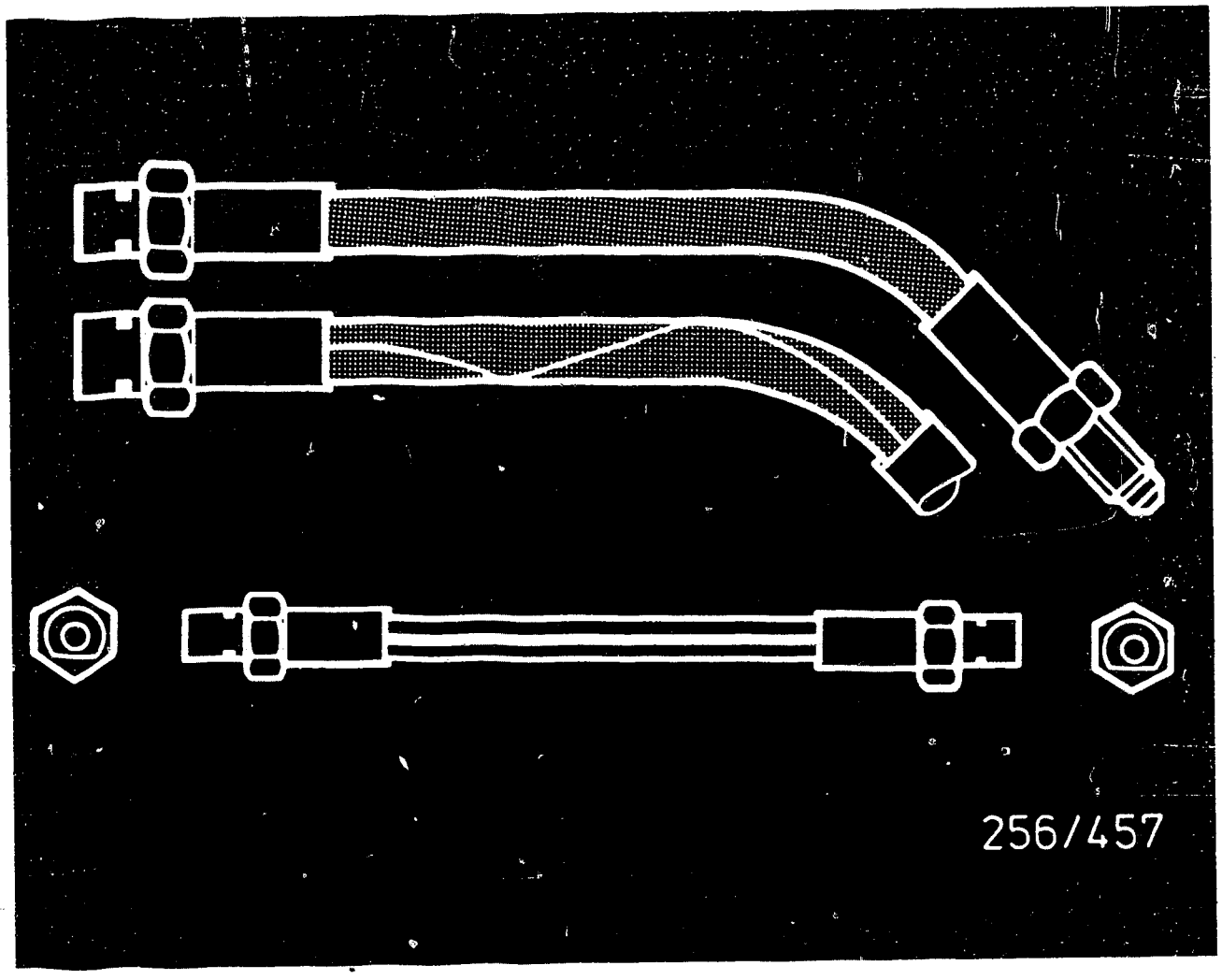
I M P O R T A N T :
Brake hoses must never be exposed to a direct spray jet.



2. Installation instructions

The brake hose must be able to unrestrictedly follow all steering and spring movements, but should be as short as possible.

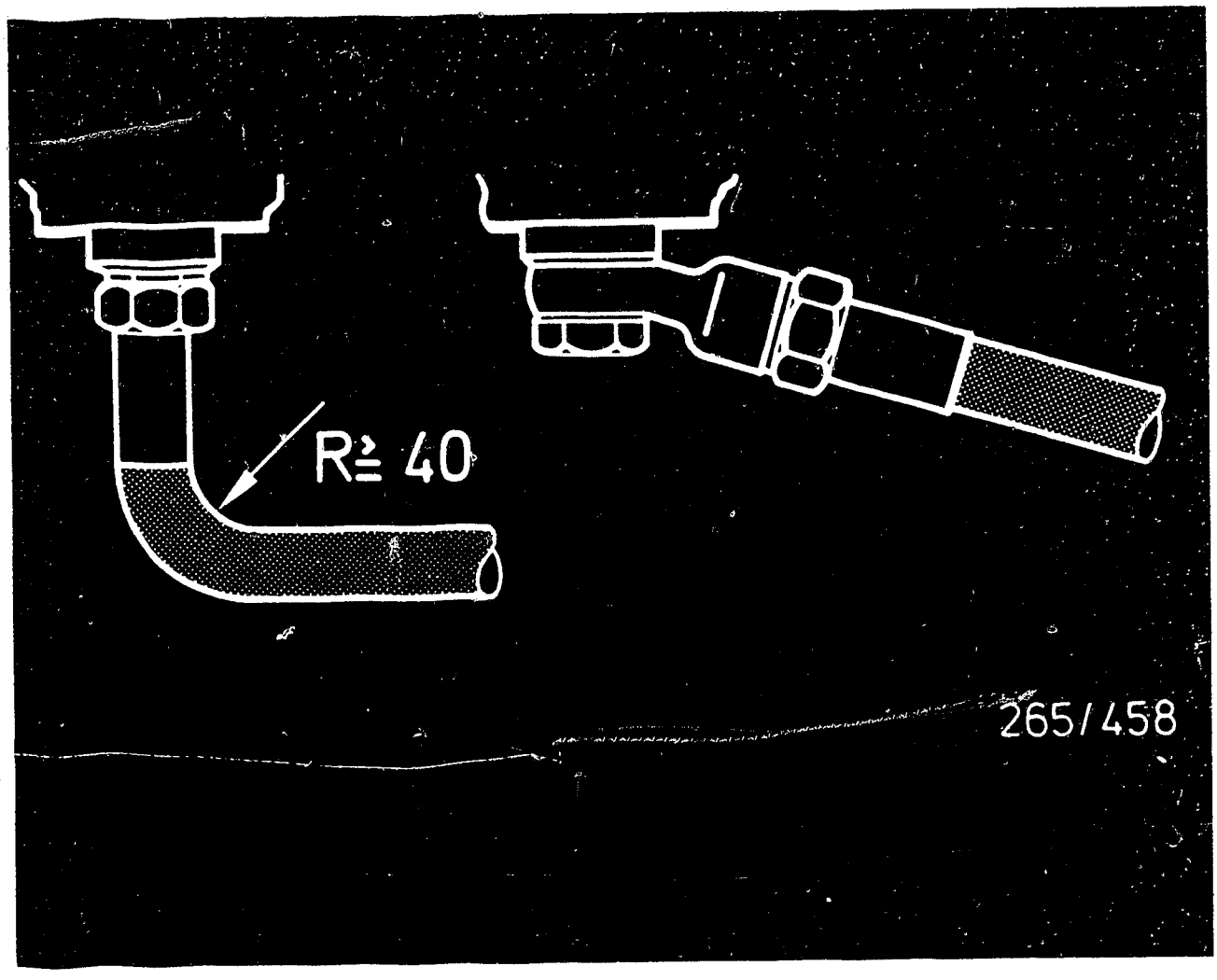
Care should also be taken to ensure that hose loops do not hang down too far.



Brake hoses must not be twisted.

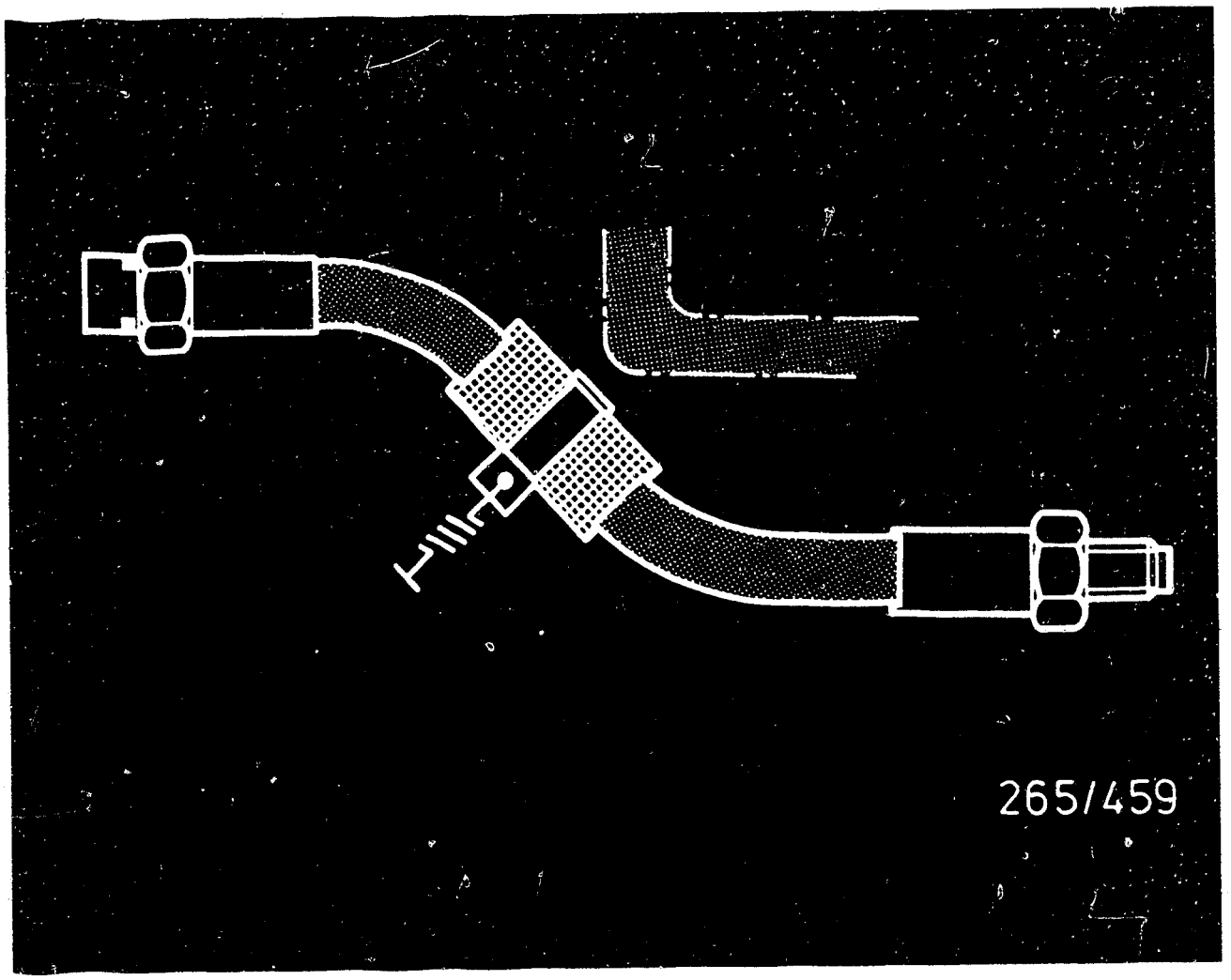
The printed-on white line represents an installation aid.

There are also hose fittings with flats which must be on the same side before and after installation.



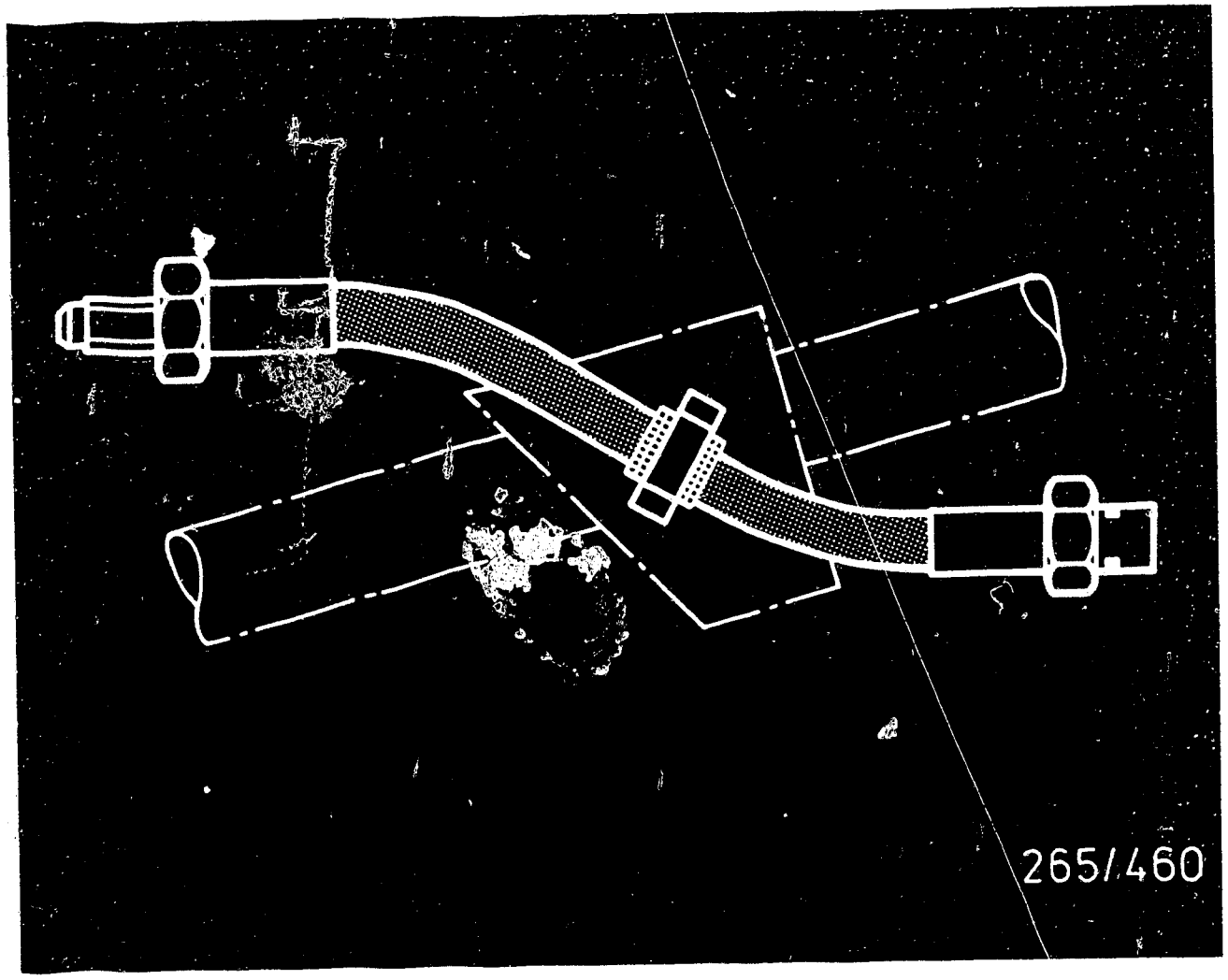
When brake hoses are bent, they must not have too narrow a radius.

If applicable, use is to be made of an inlet union.



The brake hose must be laid such that the possibility of abrasion is precluded.

If there is a danger of contact, the brake hose must be provided with a protective hose, and, if applicable, with an additional hose clamp and tension spring.



Brake hoses must not be laid in the vicinty of the exhaust system.

There must be no contact on deflection and when the wheels are fully locked.

If necessary, an additional heat shield must be fitted.

Published by:
ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

CITROEN CX 25

Motor vehicle: Pass. car
07.1988

Bleeding brake system

0114 En

The brake system is to be bled and a pressure test performed after replacing the hydraulic modulator.

Handle mineral oil with care!

a) Only pour mineral oil into containers in which there is no danger of the liquid being inadvertently used for human consumption
(C A U T I O N , T O X I C !)

b) Even slight traces of brake fluid cause the brake system to fail.
If brake fluid is found in the brake system, or if there is a suspicion of brake fluid, the entire brake system must be thoroughly flushed with mineral oil.

Note:

Over the course of its service life, the boiling point of mineral oil drops due to the constant assumption of moisture from the atmosphere.
Vapour bubbles may therefore form in the brake system if the brakes are subjected to extreme stress.

The mineral oil must be renewed every 30 000 km or once a year, preferably in Spring.

Bleeding

* No special bleeder unit is required when bleeding the brake system of the Citroen CX 25 GTi Turbo. All that is required is a collector and a transparent hose.

Front wheel brake:

* Jack up vehicle and remove wheels.

* Loosen bleeder screw of pressure regulator; empty main pressure accumulator.

* Connect transparent hose to bleeder screw at brake caliper.

  To empty the brake pressure accumulator, loosen one of the bleeder screws at the brake caliper somewhat and depress the brake pedal.

* Loosen bleeder screw, start engine and allow it to idle.
  Tighten bleeder screw of pressure regulator moderately by hand.

* The bleeding process is complete when clear, bubble-free mineral oil flows via the bleeder hose.
  Close bleeder screw again and tighten moderately by hand.

Rear wheel brakes:

Bleeding is performed under pressure.

* Jack up vehicle. Remove wheels.

* Discharge rear spring pressure.

* Attach one transparent hose each to the bleeder screws.

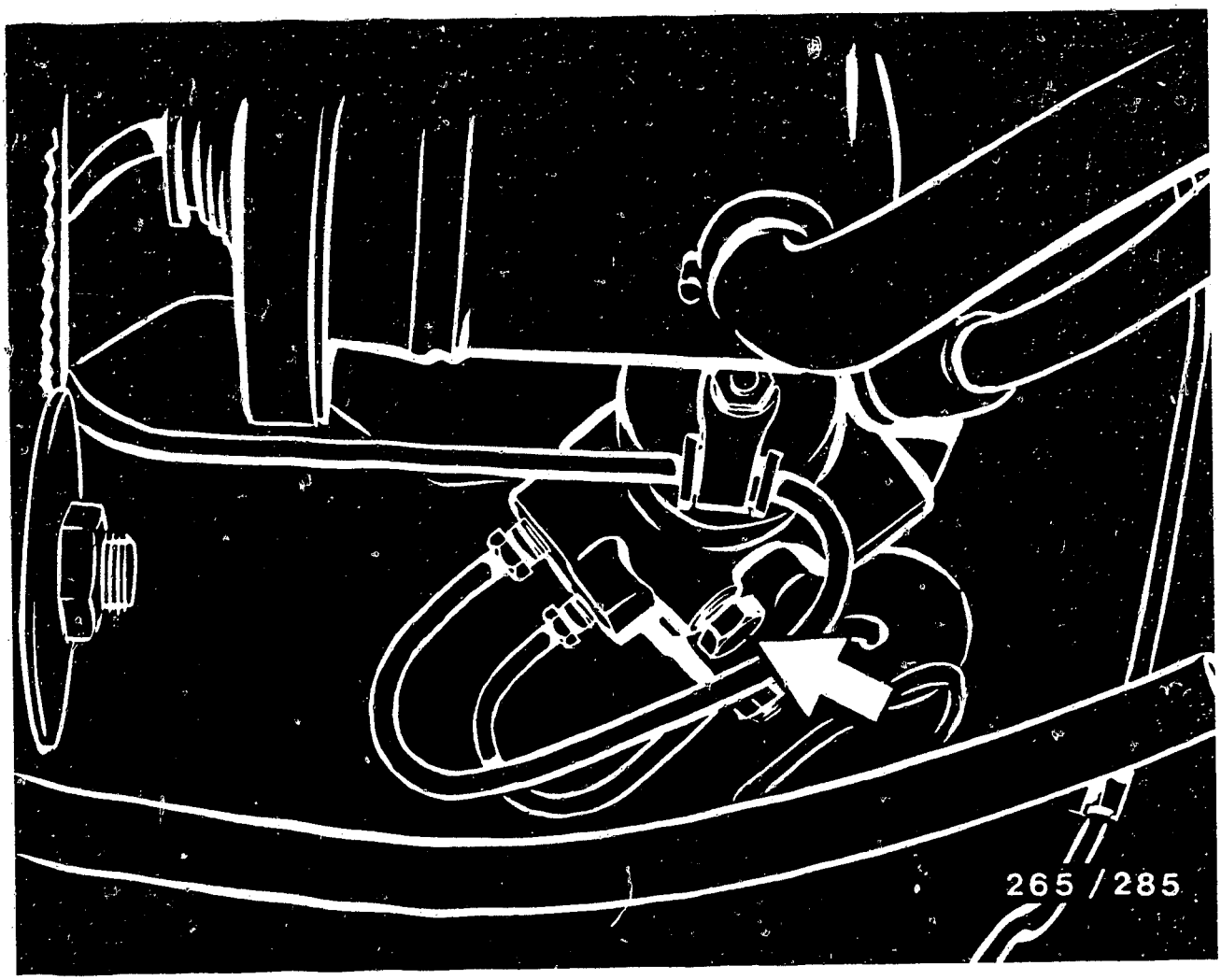
* Set ground clearance to maximum.

* Raise one of the trailing arms.

* Loosen bleeder screws.

* Slowly depress brake pedal. Start engine and allow it to idle.
  Continue bleeding until there are no bubbles in the mineral oil as it emerges.
  Tighten bleeder screws by hand and screw on moderately tight.

* After bleeding, mineral-oil tank must be full of mineral oil up to "max." mark.



Checking brake system for leaks:

* Loosen screw at pressure regulator (picture, arrow) and remove. Screw in adapter KDHB 0002/4 and connect pressure gauge KDHB 0002.

* Start engine and observe pressure gauge.
  Set value for cut-in pressure 140...150 bar
  Set value for cut-out pressure 165...175 bar

* When measuring pressure at brake caliper, screw in adapter KDHB 0002/5 and connect pressure gauge KDHB 0002.

Set value for brake pressure 62^{+2}_{-32} bar

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

TIGHTENING TORQUES FOR SPARK PLUGS

Motor vehicle: Pass. car
07.1988

0115 En

The following tightening torques must be adhered to when installing spark plugs, so as to prevent spark-plug and engine damage:

Plug thread	Light metal	Cast iron
M 10 x 1	10 ... 15	10 ... 15
M 12 x 1.25	15 ... 25	15 ... 25
M 14 x 1.25	20 ... 30	20 ... 40
M 14 x 1.25 (Conical seat)	10 ... 20	15 ... 25
M 18 x 1.5	20 ... 35	30 ... 45
M 18 x 1.5 (Conical seat)	15 ... 23	20 ... 30

Note: Values in Nm (Newton-meters) 10 Nm = approx. 1 kpm

The above-mentioned tightening torques apply to new plugs, which are slightly lubricated at the factory.
Special thread lubrication (e.g. grease containing graphite or the like) is not necessary given the nickel-plated surface of our plugs.
If thread lubrication is nevertheless performed, the maximum tightening torques of the plugs are to be reduced by 1/3.

Over-tightened plugs can be seen from loose, leaking plug ceramics or from plug shells which are broken at the thread run-out.

Generally speaking, the outer 3-layer seal ring is also extremely compressed (■ 1.4 mm) and pronounced compression marks are likewise often found at the edges of the hexagon.
Over-tightened plugs cannot be handled under warranty.

The latter also applies to spark plugs which were inadequately torqued or not tightened at all:
The contact surface of the outer plug seal is reduced or becomes ineffective due to the lack of contact pressure.

This reduces the important dissipation of heat from the plug shell to the cooled cylinder head and can result in thermal overload of the plug. Under certain circumstances, loose spark plugs can therefore even lead to engine damage on account of such poor heat dissipation.

In addition to the above-mentioned tightening torques, it is likewise advisable to repeatedly compare these values to the specifications given by the engine manufacturer in owners' manuals or in workshop documentation for the makes concerned.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

New electronic heating and climate control

General

As of 9.86 the BMW 7 series has been fitted with a new electronic heating/climate control system with the following BMW designations:

IHR (integrated heating control)
IHKA (integrated heating and climate control).

The two systems differ in terms of the greater functional scope of the electronic climate control.

This Service Information describes the electronic climate control with the maximum functional scope.

The control unit is linked to the system via four 26-pole AMP. connectors.

The passenger-compartment temperature is regulated with these systems on the water side.

The temperature can be controlled separately for the driver and passenger sides (Duo-Heizmatik) as described in the Technical Bulletin "New Product" PKW-038 J13.

With electronic climate control, the air distribution can additionally be adjusted separately for both driver and passenger sides.

Input	Processing	Output

Control unit:

Pass.-compartment sensor
Program selector switch

Rotary temperature switch

Rotary blower switch

Switch for rear-window heating

Stratification adjuster

Outside temperature sensor

Injection temperature sensor left / right

On-board computer

- Auxiliary heating
- Auxiliary ventilation

Start recognition

Diagnosis call-up

⟹

Control unit

Regulation of pass.-compartment temp.

Control functions:

- Flap adjustment
- Air flow
- Auxiliary heating water pump
- Rear-window/ windscreen heating

⟹

Blower

Stepping motor

- Defrost
- Ventilation
- Fresh air
- Footwell with rear compartment
- Stratification

Water valves

Auxiliary water pump

Rear-window/ windscreen heating

Diagnosis output

Functional scope of control unit for electronic heating control:

* Regulation of passenger-compartment temperature

  - Actuation of heating water valves (clocked) as a function of temperature sensors and set-value adjusters (rotary temperature switches).

  - Actuation of heating water pump only with heating control switched on

* Control of air distribution

  - Actuation of stepping motors of fresh-air flap, ventilation, defroster, footwell/rear ventilation and temperature stratification flaps

* Control of windscreen and rear window heating

* Control of air flow

* Self-diagnosis

Input	Processing	Output
Control unit: Pass.-compartment sensor Program selector switch Temperature selector wheels Blower selector wheel Switch for rear-window heating	⟹ Control unit Regulation of pass.-compartment temperature Control functions: – Flap adjustment – Air flow – Auxiliary heating water pump – Evaporator temperature – Cold-start interlock – Rear-window/windscreen heating	⟹ Blower Magnetic coupling Refrigerator compressor Auxiliary fan Stepping motor – Defrost – Circulating air – Rear compartment – Ventilation – Fresh air – Footwell with rear compartment – Stratification left / right Water valves Auxiliary water pump Rear-window/windscreen heating Speed boost Diagnosis output
Stratification adjuster Rear-compartment switch Outside temperature sensor Driving speed Evaporator temperature sensor Injection temperature sensor left / right On-board computer – Auxiliary heating – Aux. ventilation Start recognition Diagnosis call-up		

Functional scope of control unit for electronic climate control:

* Regulation of passenger-compartment temperature

  - Actuation of heating water valves (clocked) as a function of temperature sensors and set-value adjusters (temperature selector wheels).

  - Actuation of heating water pump only with heating control switched on

  - Actuation of magnetic coupling of refrigerator compressor

  - Cold-start interlock

* Control of air distribution (driver and passenger side separate)

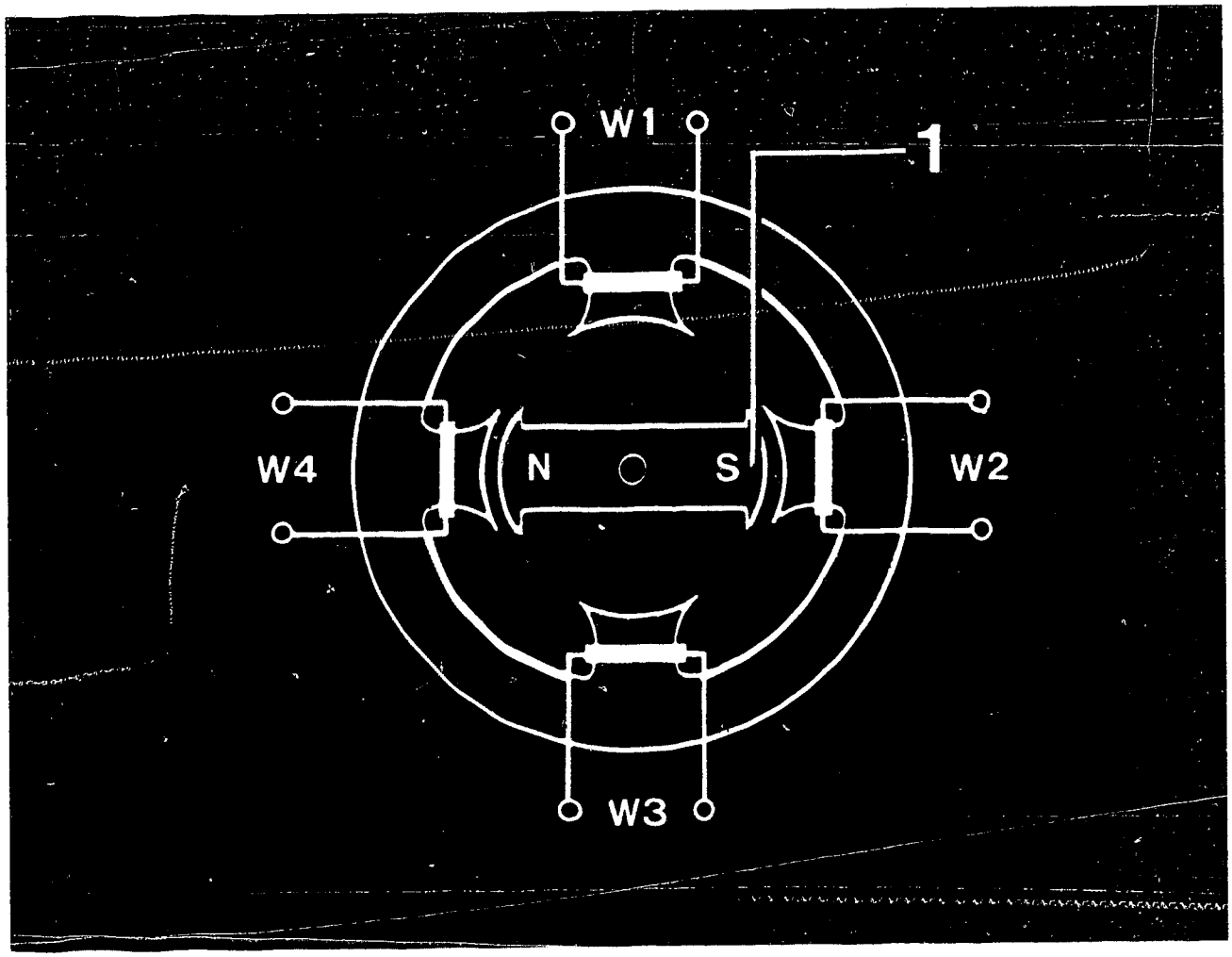
  - Actuation of stepping motors of fresh air, circulating air, defroster, temperature stratification flaps: footwell, rear ventilation and vent flap

* Control of windscreen and rear window heating

* Control of air flow

* Actuation of additional fan

* Self-diagnosis



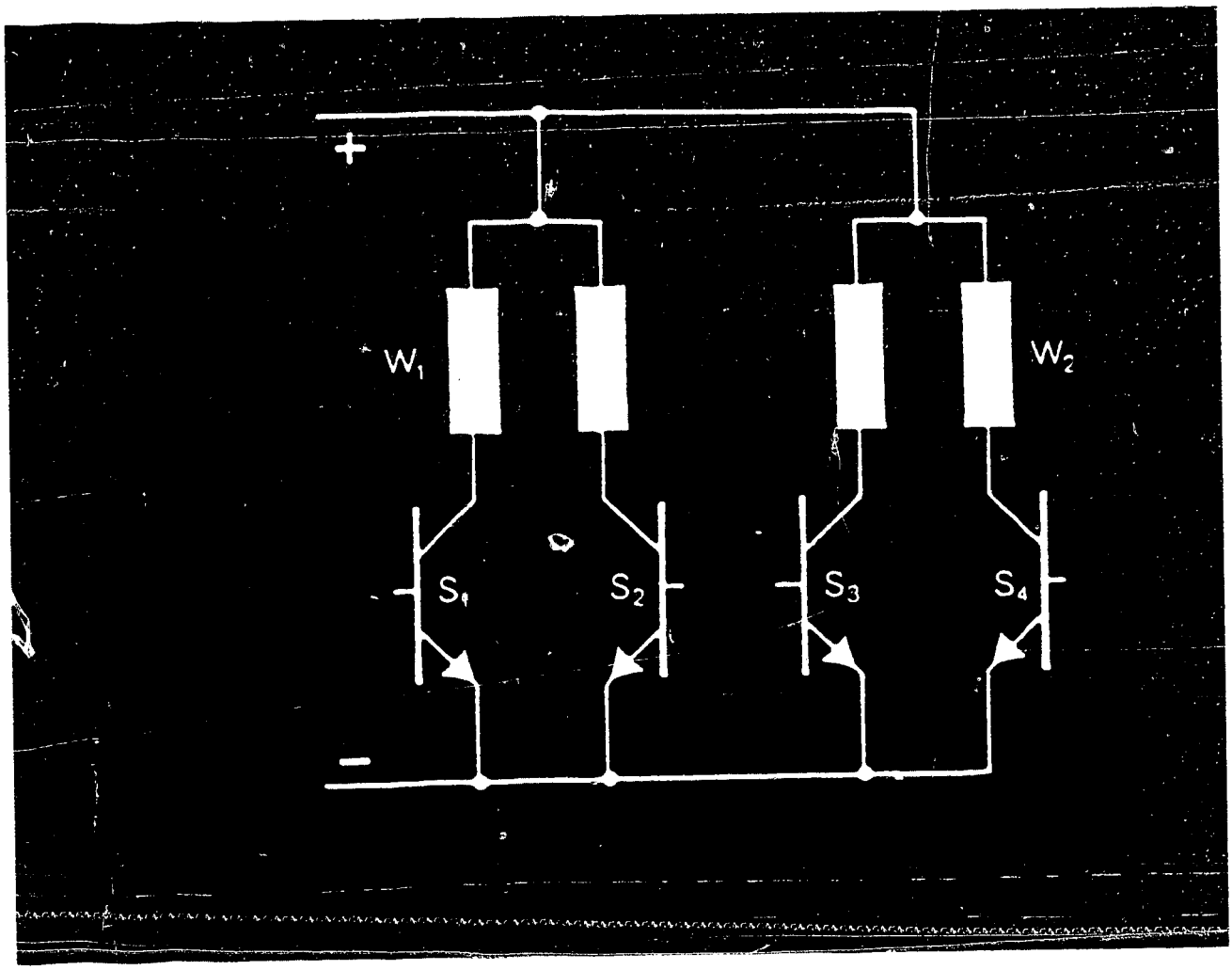
1 = Rotor, permanent magnet W1 – W4 = Stator winding

Air distribution

The various air distribution flaps are adjusted by means of stepping motors by the electronic control unit. The current flap position is detected by the control unit from the number of motor steps and stored. The fresh-air flaps are adjusted by a motor with varying opening and closing speed. The fresh-air flaps are opened for comfort reasons within 12 seconds and closed within 2 seconds.

Functional description of the stepping motors:

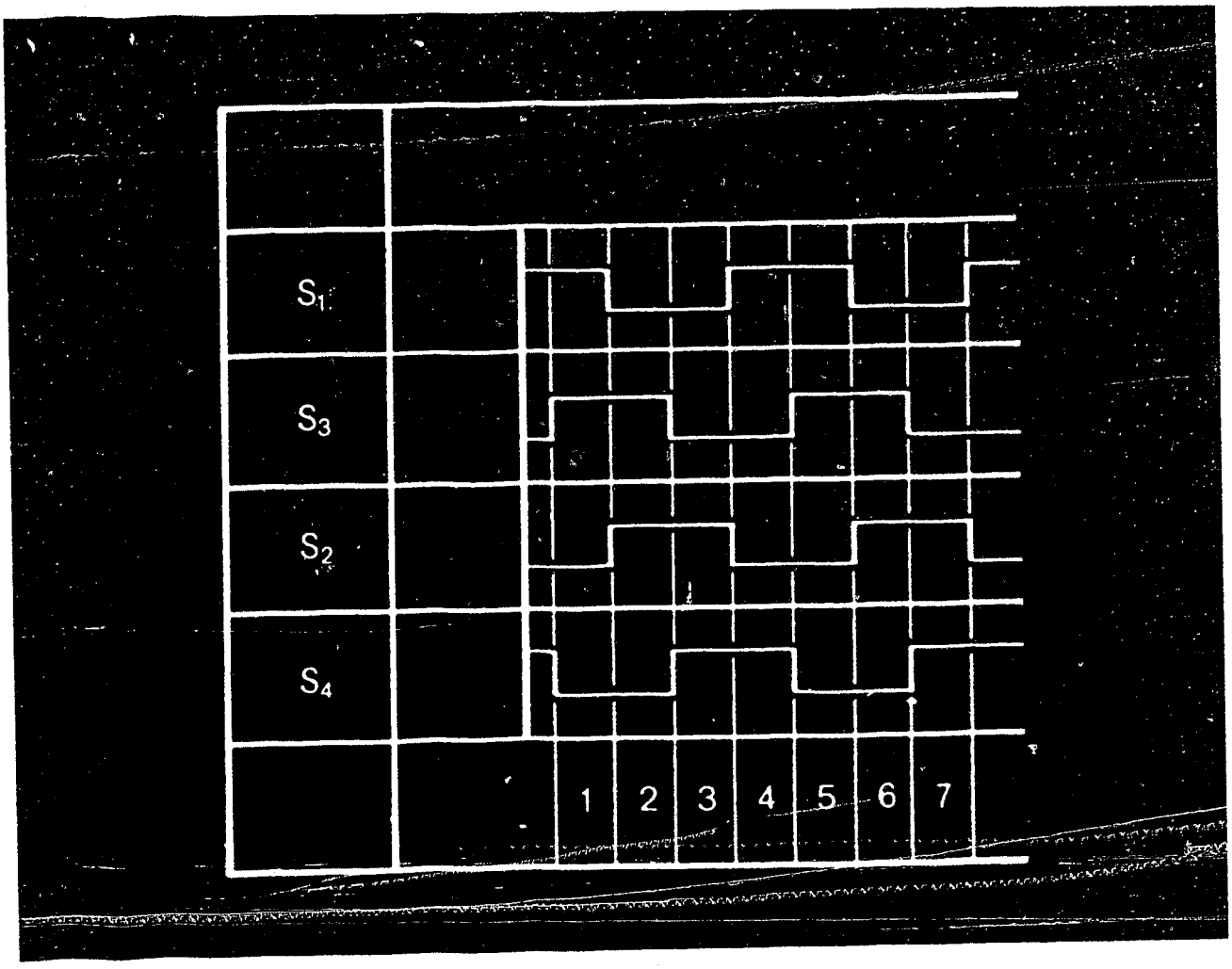
Stepping motors are actuated by digital pulses. The motor rotates in defined steps as soon as it is actuated by current pulses. As regards motor-vehicle electronics, use is made of permanent-magnet stepping motors.



W1,W2 =Stator winding pairs
S1–S4 =Electron. switches for actuation of stator windings

Equivalent diagram of a stepping motor

Actuation of stepping motors:
Pulses must be supplied to the stator windings in a suitable sequence if the rotor of a stepping motor is to be caused to rotate.
The number of pulses required for one revolution of the motor is a function of the number of stator poles and the mechanical configuration of the windings. This also determines the magnitude of the angle of rotation per step.
Stepping motors can be stopped in any angular position and started again.



Signal/time chart for stepping-motor actuation

S1 – S4 = Electronic switches for actuation of stator windings

Rear-window heating control

The rear-window heating is switched between rapid defrost and clocked operation.

The rapid defrost stage is switched on by pressing the rear-window-heating button on the controls. The rear-window heating is automatically switched after 10 minutes to clocked operation by the heating/climate control unit. Pressing the rear-window-heating button again causes the rear-window heating to be switched off in rapid defrost operation and switched to rapid defrost again in clocked operation. The current consumption is reduced to 1/3 in clocked operation.
Clock times: t ON = 40 s, t OFF = 80 s

The rear-window heating is switched on automatically in the defrost program.

Windscreen heating

The lower part of the windscreen is heated electrically to stop the wiper blades freezing up.

The heating is controlled as a function of the outside temperature:

The windscreen heating is switched on at temperatures below 5°C and switched off at temperatures in excess of 8°C.

Control of air flow and ram-pressure compensation

Control of air flow

The amount of air (blower speed) is controlled as a function of:

- The position of the blower selector wheel
- A manipulated variable formed in the heating/climate control unit
- Driving speed
- The cold-start interlock

Ram-pressure compensation

Ram-pressure compensation is achieved as of a driving speed of 10 km/h to 60 km/h by reducing the blower voltage (linearly by max. 1.5 V) with the fresh-air flaps fully open. Such reduction is not effected in circulating-air operation.

Between 60 km/h and 140 km/h ram-pressure compensation is effected by closing the fresh-air flaps continuously until they are approximately 40 % open (only if fresh-air flaps are opened by program).

Auxiliary heating, auxiliary ventilation

If auxiliary heating is fitted as a special accessory, the passenger-compartment temperature, the blower speed and the air distribution are set by the heating/climate control unit in auxiliary heating operation. Operation of the auxiliary heating is effected by way of the on-board computer or a multi-function clock.

Cold-start interlock

In order to prevent drafts in the passenger compartment, the air distribution is set to defrost and the blower runs at a minimal voltage of 3 V on cold starting (as a function of the left-hand heat-exchanger temperature).

Cold-start interlock is not possible in the defrost program and with the air-flow selector set to maximum.

Defrost run following ignition off

The positions of the air-distribution flaps are determined by storing the adjustment steps. These flap positions remain stored for 1 minute following switch off of the ignition; the defrost flap setting is then assumed for functional and adjustment reasons. The control unit is only deenergized and switched off after approx. 2 minutes.

Adjustment run following disconnection of battery

Disconnection of the battery causes the stored flap positions to be cancelled. The control unit then actuates the individual stepping motors with a maximum number of steps. This causes the flaps to be adjusted to their end position "open" or "closed". The adjustment run lasts for between approx. 30 and 40 s. The control unit then sets the flap positions corresponding to the selected program.

Provision of substitute values (limp-home function)

The control unit effects adjustment to average substitute values in the event of failure of temperature set-value adjusters, temperature sensors, air-flow selector wheel and stratification adjuster.

Self-diagnosis

The control unit is equipped with self-diagnosis. Should faults occur in the system, these are stored in the fault memory. The fault memory is cleared as soon as the control unit is deactivated following switch off of the ignition. The fault memory can only be read out via the built-in diagnosis interface using a diagnosis tester (e.g. KTS 300).

Circuit diagram:

A circuit diagram has been drawn for this system instead of the schematic diagram.

The overall circuit diagram is broken down into several follow-up diagrams.

Branches are indicated by way of reference boxes (with two fields).

In the event of branching within the circuit diagram to a follow-up diagram, the reference box first indicates the current path and then the component.

In the event of branching to components not drawn in on the circuit diagram, the reference box first indicates the components and then the terminals.

Advantages of circuit diagram:

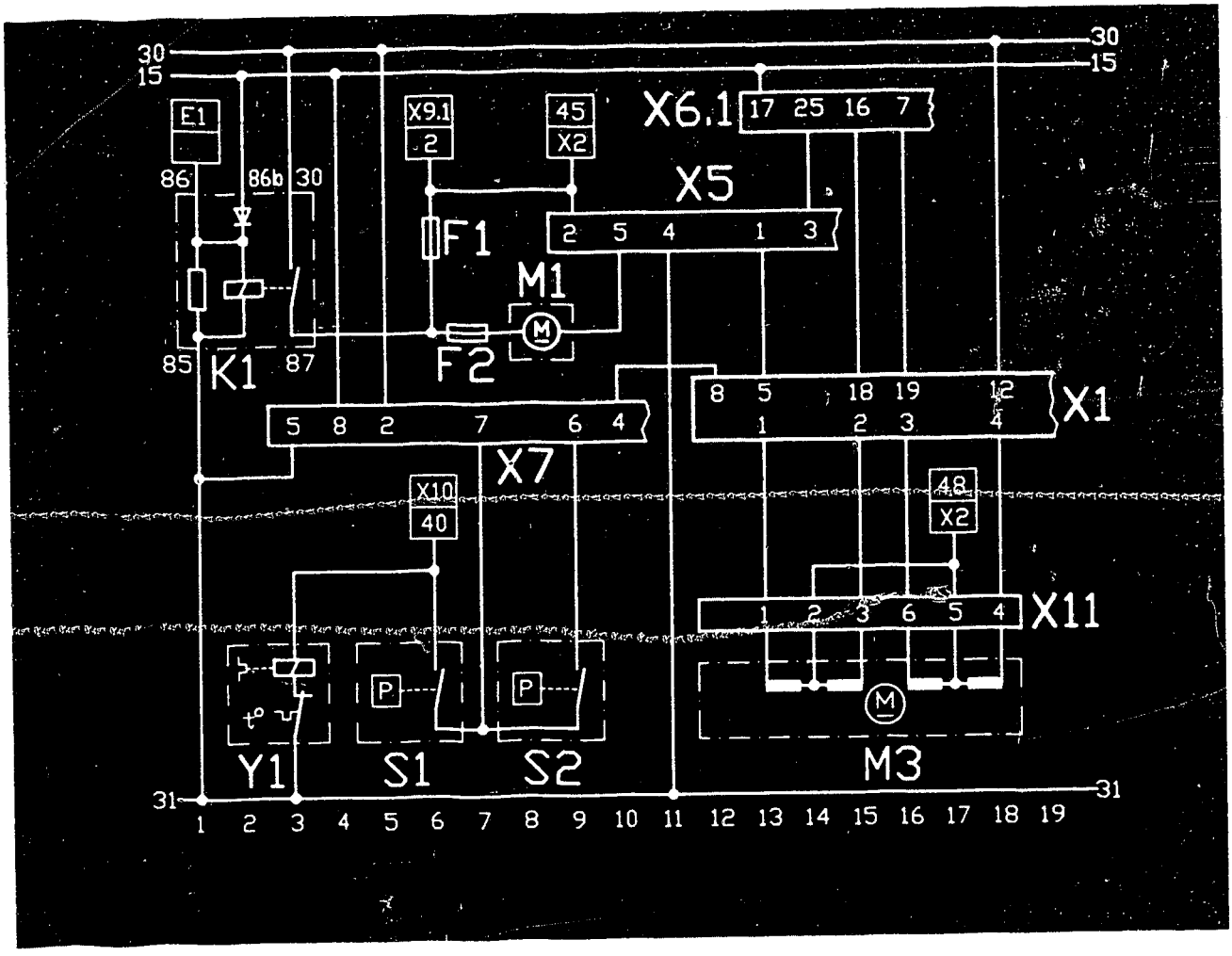
* Clear-cut representation

* Standard symbols

* Uniform brief designation of components

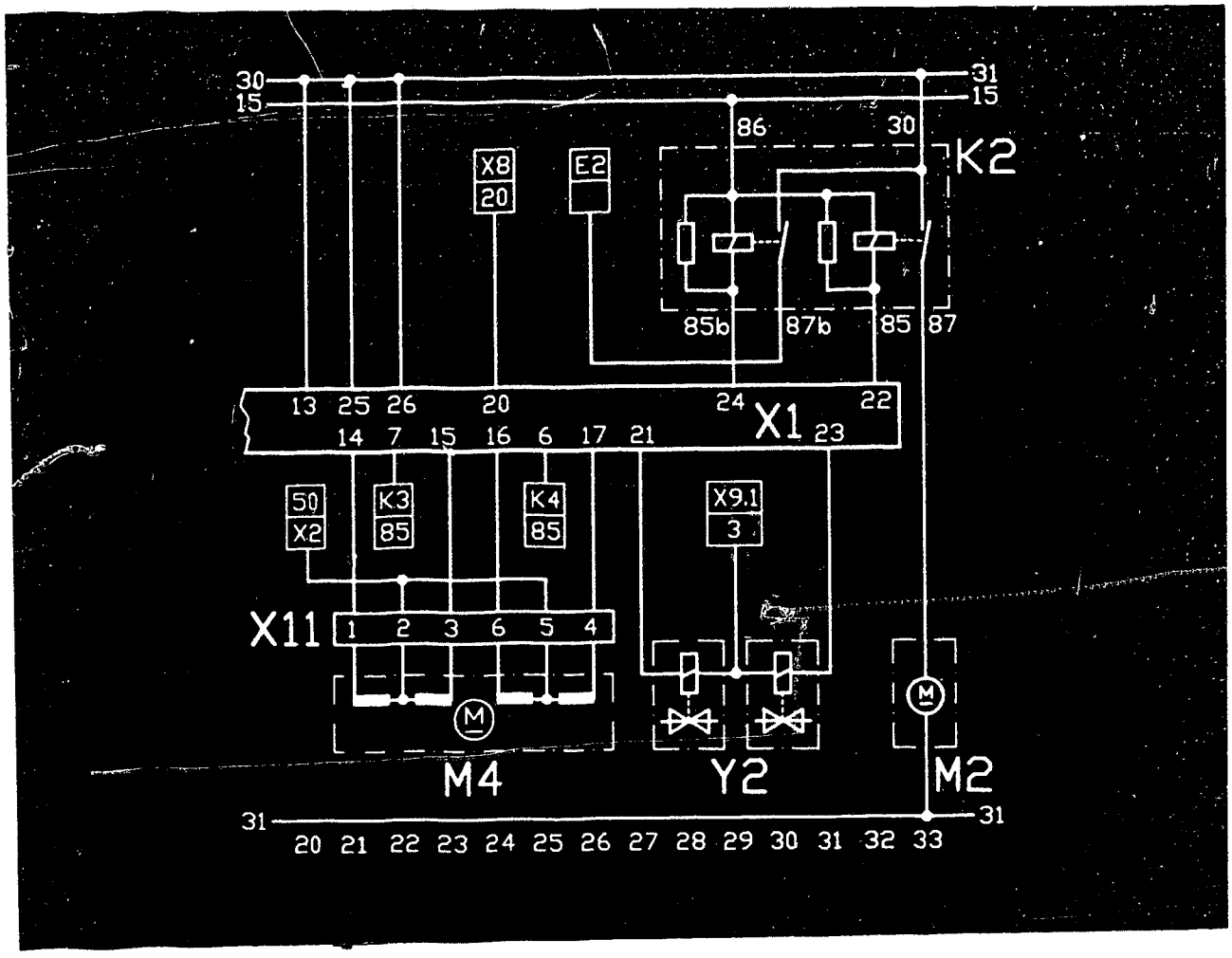
* Complicated systems can be broken down into sub-diagrams.

* System variants can be presented in follow-up diagrams.



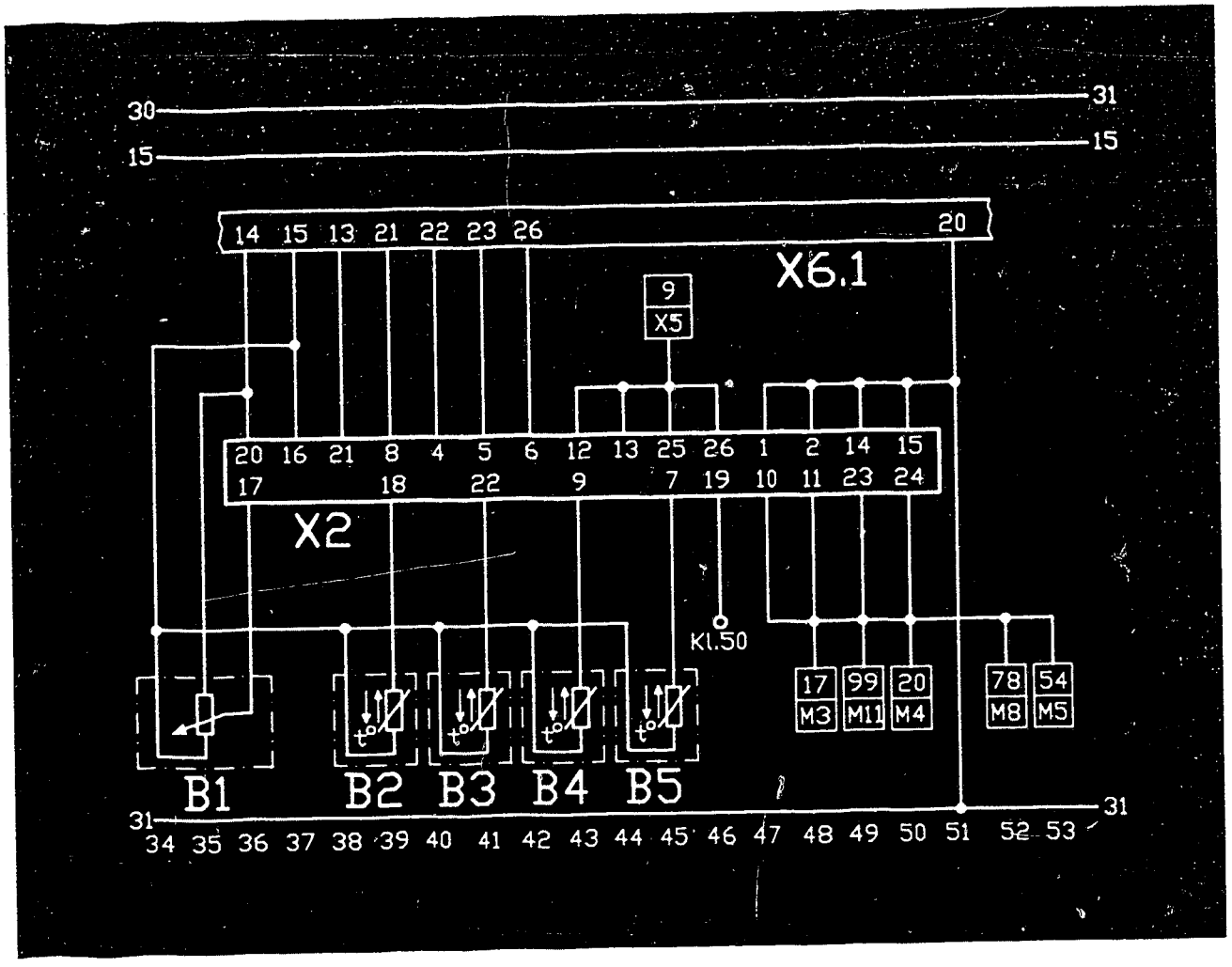
Circuit diagram of electronic A/C

E1 = From auxiliary heating
K1 = A/C relay
S1 = Low-pressure switch
S2 = High-pressure switch
M1 = Blower motor
M3 = Stepping motor, circulating-air flap
X1 = Plug, control unit, A/C, white
X2 = Plug, control unit, A/C, blue
X5 = Plug, blower regulator
X6.1 = Plug, control unit (26-pole), socket connector
X7 = Plug, compressor control unit
X10 = Plug, Motronic control unit
X11 = Plug, stepping motor
Y1 = Compressor coupling



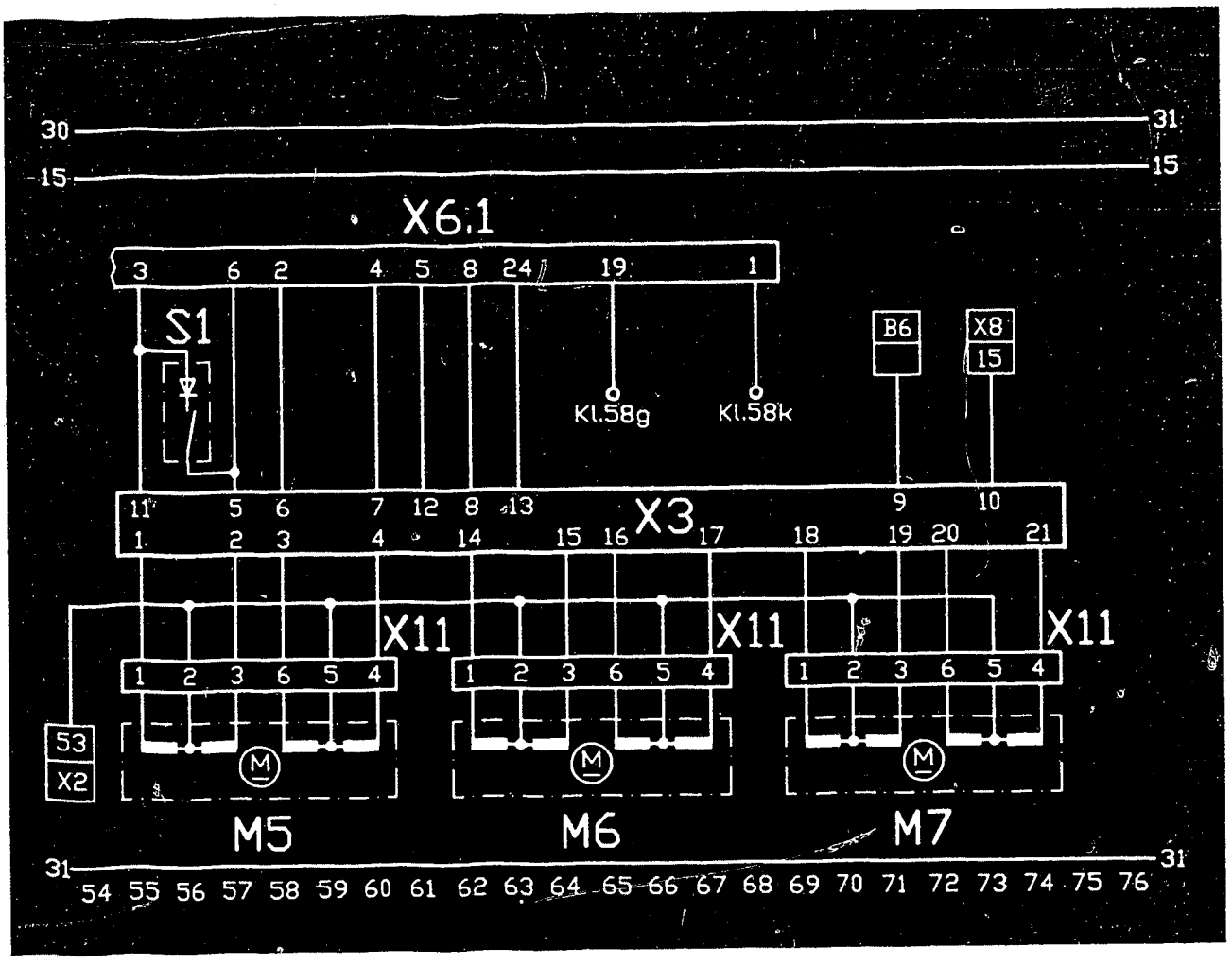
Circuit diagram for electronic A/C (continued)

E2 = To windscreen heating
K2 = Relay, windscreen heating/heating water pump
K3 = Relay, rear-window heating
K4 = Relay, auxiliary fan
M2 = Heating water pump
M4 = Stepping motor, rear-compartment flap
X1 = Plug, control unit, A/C, white
X2 = Plug, control unit, A/C, blue
X8 = Diagnosis socket
X9.1 = Plug, control unit (3-pole)
X11 = Plug, stepping motor
Y2 = Duo heating water valve



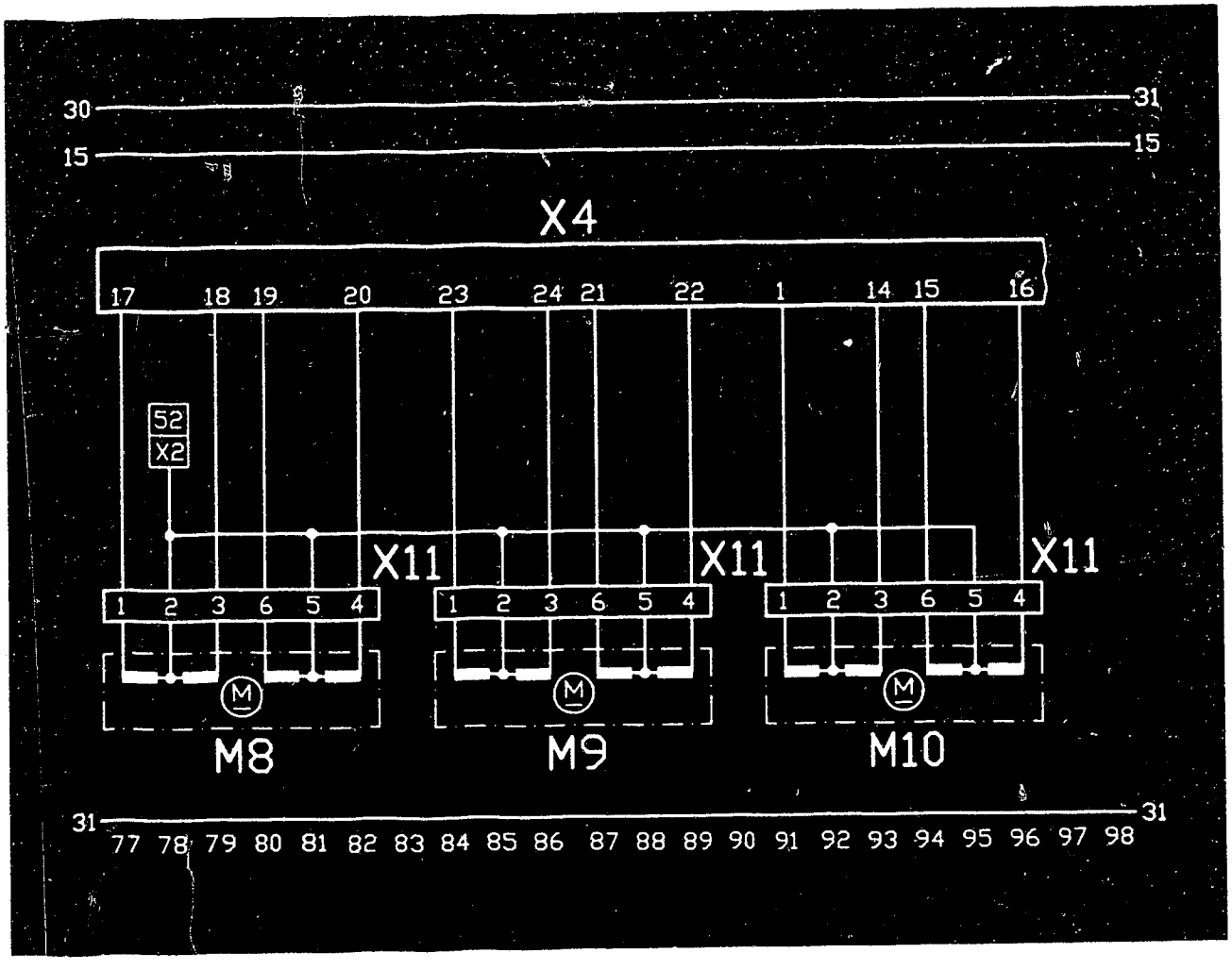
Circuit diagram for electronic A/C (continued)

B1 = Stratification adjuster
B2 = Injection temperature sensor, left
B3 = Injection temperature sensor, right
B4 = Evaporator temperature sensor
B5 = Outside temperature sensor
M3 = Stepping motor, circulating-air flap
M4 = Stepping motor, rear-compartment flap
M5 = Stepping motor, footwell flap, right
M8 = Stepping motor, defroster flap
M11 = Stepping motor, stratification, left
X2 = Plug, control unit, A/C, blue
X5 = Plug, blower regulator
X6/1 = Plug, control unit (26-pole), socket connector



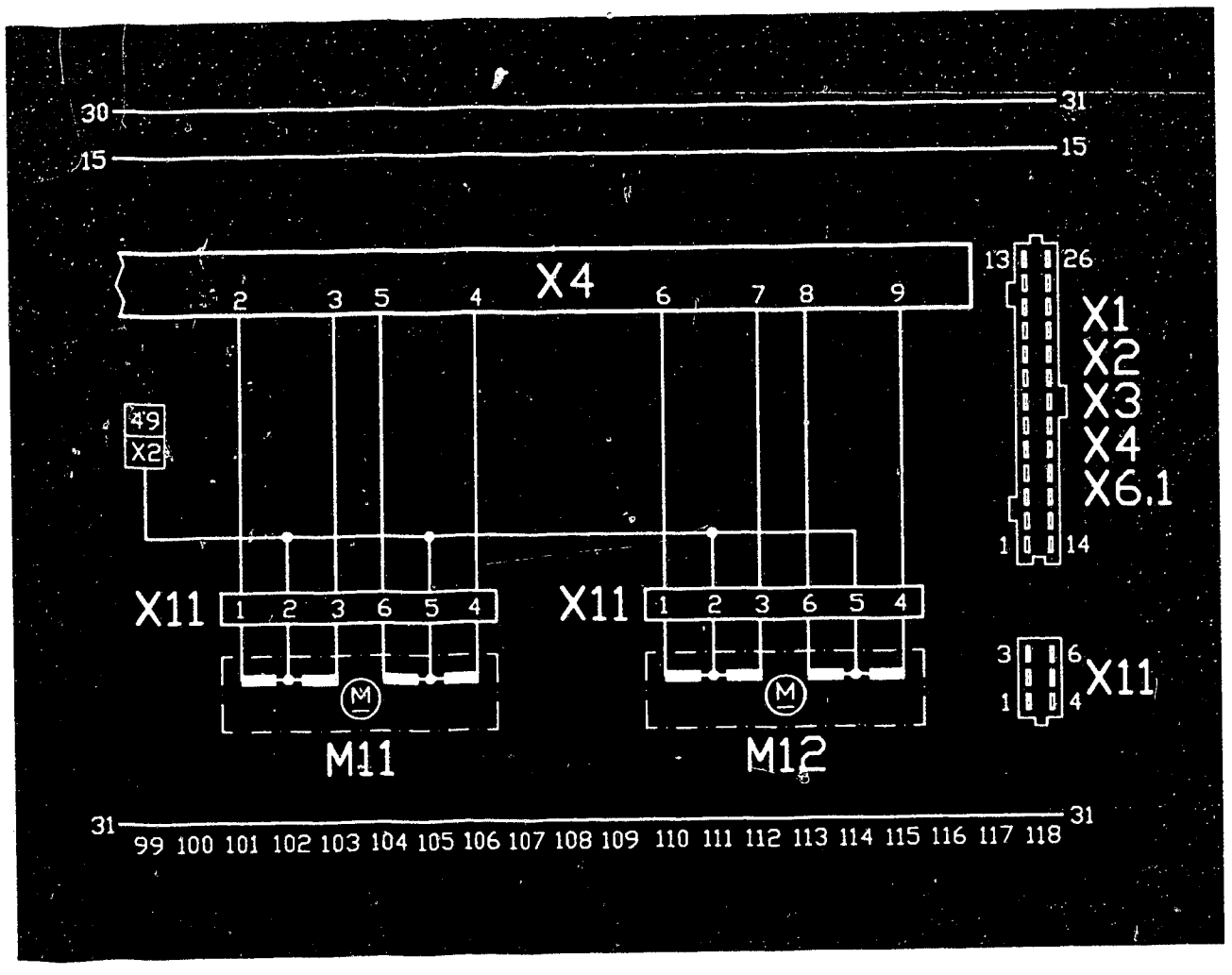
Circuit diagram for electronic A/C (continued)

B6 = Speedometer (speed signal)
S3 = Switch, footwell adjuster
M5 = Stepping motor, footwell flap, right
M6 = Stepping motor, ventilation, right
M7 = Stepping motor, stratification, right
X2 = Plug, control unit, A/C, blue
X3 = Plug, control unit, A/C, yellow
X6/1 = Plug, control unit (26-pole), socket connector
X8 = Diagnosis socket
X11 = Plug, stepping motor



Circuit diagram for electronic A/C (continued)

M 8 = Stepping motor, defroster flap
M 9 = Stepping motor, ventilation, left
M10 = Stepping motor, footwell flap, left
X 2 = Plug, control unit, A/C, blue
X 4 = Plug, control unit, A/C, green
X11 = Plug, stepping motor



Circuit diagram for electronic A/C (continued)

M11 = Stepping motor, stratification, left
M12 = Stepping motor, fresh-air flap
X 2 = Plug, control unit, A/C, blue
X 4 = Plug, control unit, A/C, green
X11 = Plug, stepping motor

Published by:

Robert Bosch GmbH Division KH
After-Sales Service Department for Training and Technology
(KH/VSK)
Please direct questions and comments concerning the contents
to our authorized representative in your country

BMW VEHICLES

Motor vehicle: pass. car
09.1988

BOSCH car alarm 20s, 20c, 20i

0124 En

Start-interlock configuration

Some BMW vehicles are equipped with a relief relay which causes certain loads to be switched off when starting. The winding of this relay is connected to terminals 15 and 50 with the result that it receives its negative potential via the windings of the starting-motor solenoid switch.

If there is an open-circuit in lead 50, the relief relay can no longer resume its on-position. Furthermore, pin 4 of the Jetronic/Motronic control unit, which is likewise connected to terminal 50, receives positive potential via the winding of the relief relay. This means that the starting enrichment is in constant operation when the ignition is switched on and the engine dies as a result of overenrichment.

We should like to take this opportunity of pointing out that the relay K2 of the car alarm systems 20s/c/i is not to be connected such that it only assumes its on-position when starting. The fault described above otherwise occurs with the BMW vehicles indicated. As shown in the fitting instructions, the winding of the relay K2 must be connected to terminal 15 and V.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/KBT).

Please direct questions and comments concerning the contents to our authorized representative in your country.

CAR ALARM SYSTEMS 20c AND 20i

Vehicle: Passenger car
09.1988

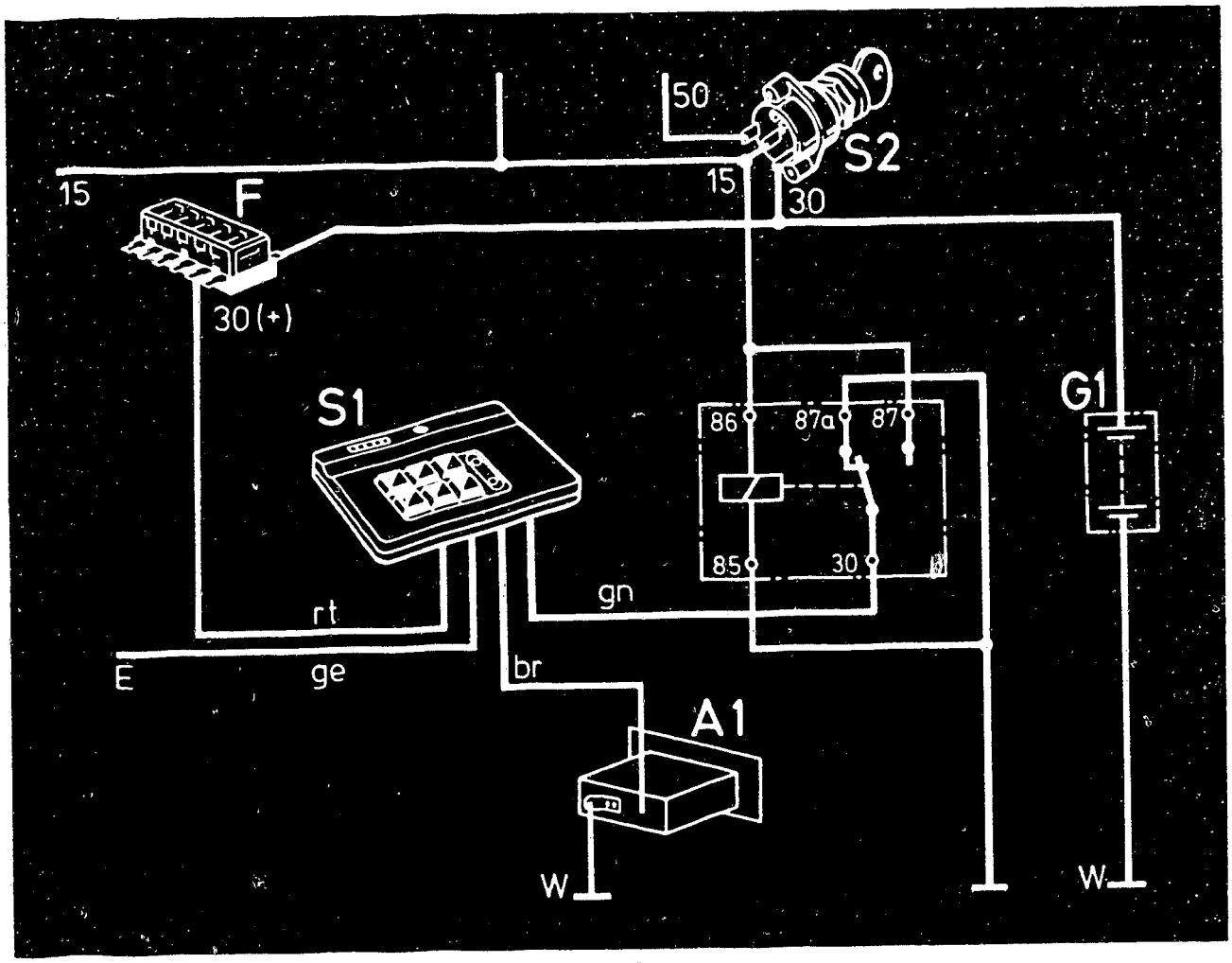
Activation interlock

0127 En

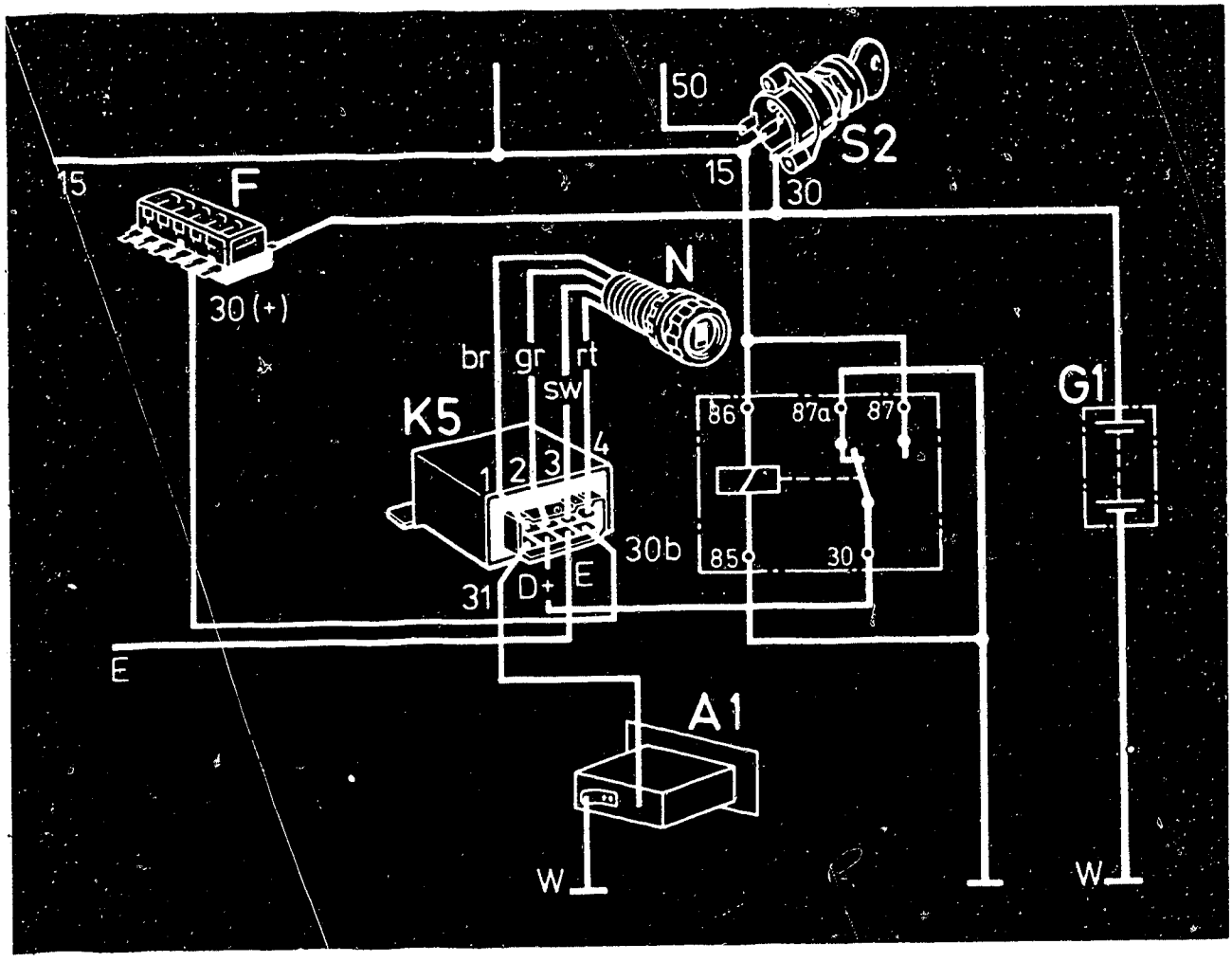
These car alarm systems can only be activated and deactivated if there is a negative connection at the green lead of the encoding switch (CA 20c) or at connection D+ of the evaluation electronics (CA 20i).

These connections connected to terminal 15 of the ignition and starting switch are provided with negative potential via instruments and indicator lamps when the ignition is switched off.

We have established that not all vehicles have reliable negative potential at terminal 15 when the ignition is switched off.
To avoid operating problems, we recommend installing a relay (change-over contact 0 332 204 125) in accordance with the following functional schematics.



Car alarm 20c



Car alarm 201

Published by: ROBERT BOSCH GMBH Division KH
Technical After-Sales Service (KH/KBT).
Please direct questions and comments concerning the contents
to our authorized representative in your country.

AUDI 100, AUDI 200 TURBO

Vehicle: Passenger car
10.1988

Supplementary equipment set for radiator fan run-on

0128 En

Hot-starting problems are often caused by the formation of vapor bubbles in the fuel-injection tubing.
Vapor bubbles occur in the event of heat concentration after switching off the engine. Leaks in the fuel-injection system and a poor grade of fuel can contribute to the formation of vapor bubbles.

Proper functioning of the ignition and fuel-injection systems is to be checked before carrying out additional conversion work.
As regards the fuel-injection system, particular attention is to be paid to the following:

- Leaks in the system as a whole
- Leaks in the injection valves
- Correct position of sensor plate

If engine and components are functioning properly, and given a good grade of fuel, the fuel-injection tubing and injection valves have to be cooled in order to improve hot-starting behavior.
With new vehicles, cooling is achieved by way of radiator fan run-on with the engine stopped. Such a radiator fan run-on facility can be retrofitted on older models.

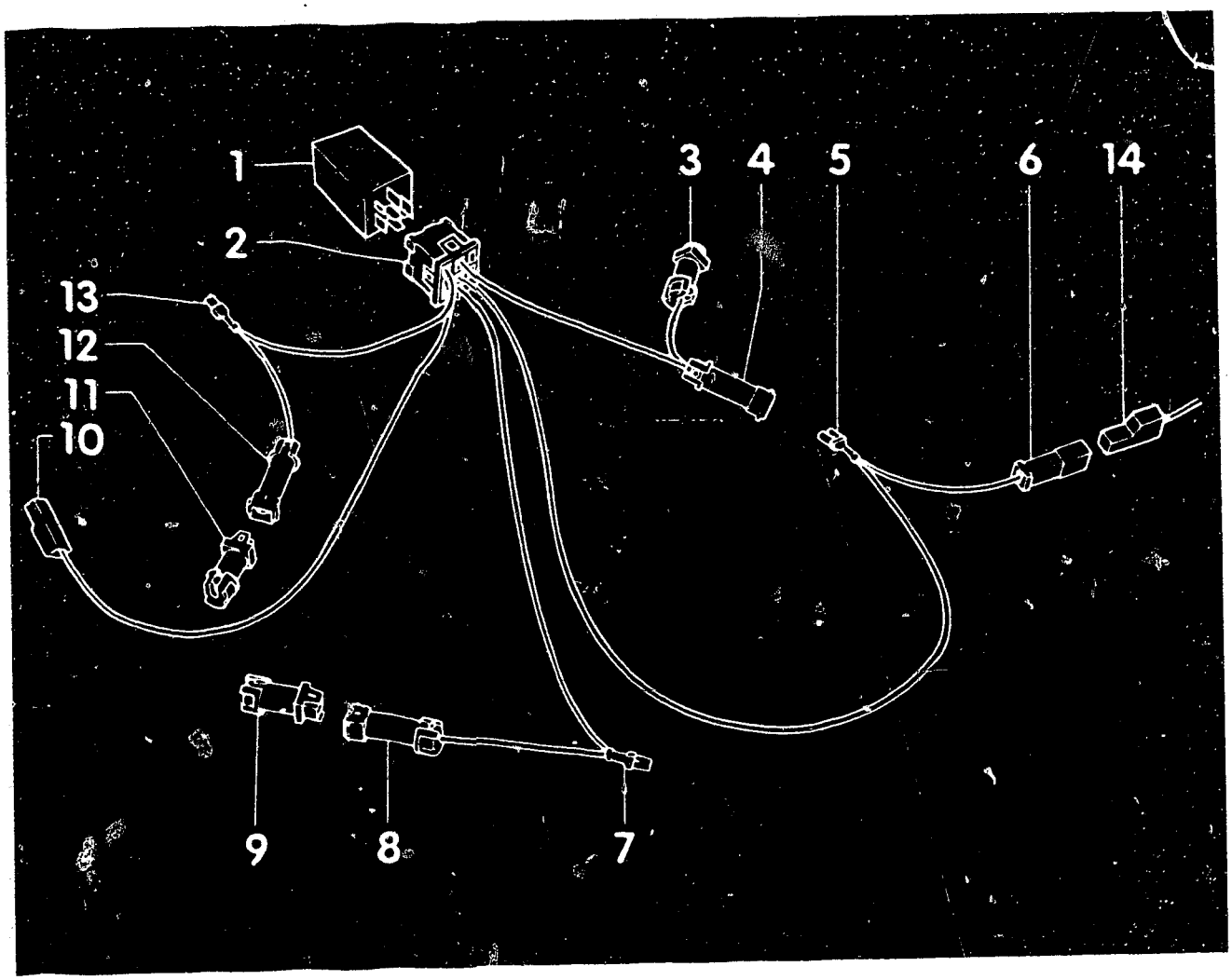
Retrofitting involves the installation of a control unit which allows the fan of the radiator to run on until the engine ambient temperature is approximately 100° C.
The maximum run-on time is 10 minutes.
The control unit with wiring harness can be obtained from your V.A.G. Dealer under the following part numbers:

Audi 200 TURBO 07.82->06.84 - 447 971 296 A

Audi 200 TURBO 07.84->06.85 - 447 971 296

Audi 200 TURBO 07.85->06.86 - 447 971 296 B

Audi 100 ->06.84 (Chassis no. 44 F. 109 525) - 443 998 215



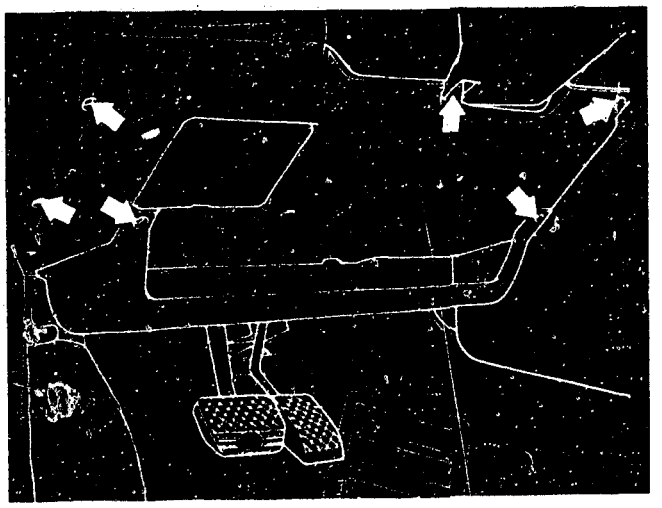
1 = Control unit for radiator fan run-on
2 = Control-unit base
3 = Housing (white)
4 = Housing (white)
5 = Lead (red/blue)
6 = Housing (white)
7 = Lead (blue/red)
8 = Housing (green)
9 = Housing (green)
10 = Ground lead (brown)
11 = Housing (blue)
12 = Housing (blue)
13 = Lead (blue/red)
14 = Housing (white)
15 = Sticker (not illustrated)

SUPPLEMENTARY EQUIPMENT SET FOR AUDI 200 TURBO

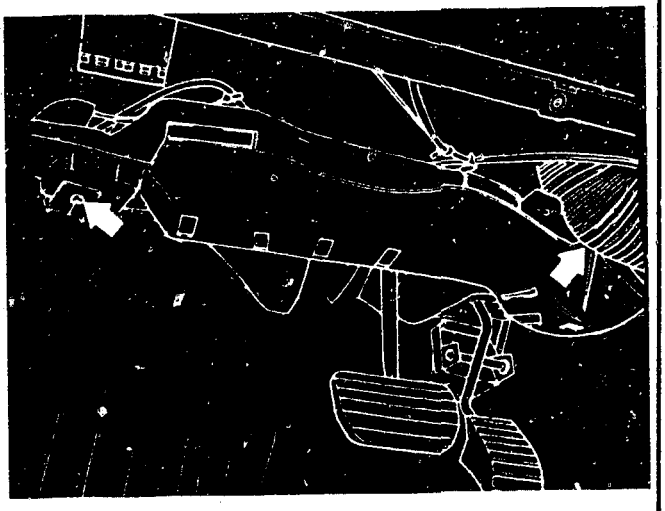
INSTALLATION INSTRUCTIONS FOR
AUDI 200 TURBO AND AUDI 100

* Disconnect negative terminal of battery

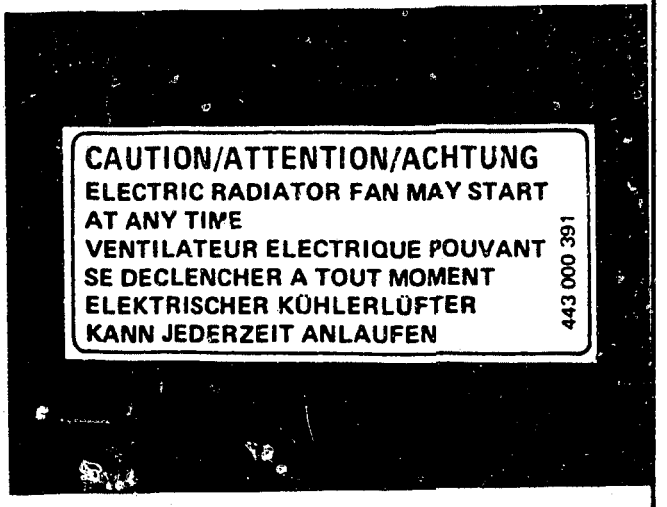
* Remove trim in footwell, front left (top picture).



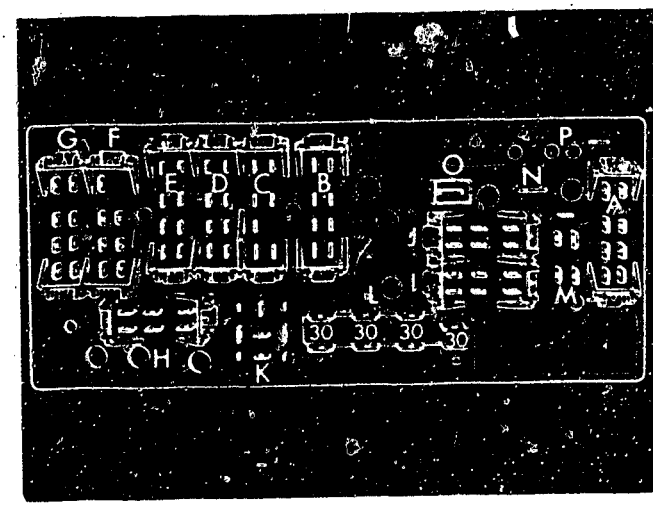
* Remove air duct, bottom left and unclip footwell light (if applicable) (center picture).



* Attach warning label to radiator cowl (bottom picture).



INSTALLATION INSTRUCTIONS FOR
AUDI 200 TURBO



* Attach control-unit base 2 to relay plate in position K.

* Attach brown lead 10 to ground star.

* Connect lead 13 (blue/red) to lead in cavity 2 of green 8-contact plug.

Additional installation instructions

Year of manufacture 07.82->06.83 with no air conditioner:

* Connect lead 7 (red/brown) to lead in cavity 7 of yellow 8-contact plug.

Year of manufacture 07.82->06.84 with air conditioner
07.84->06.85 with no air conditioner:

* Connect lead 7 (red/brown) to lead in cavity 1 of gray 8-contact plug.

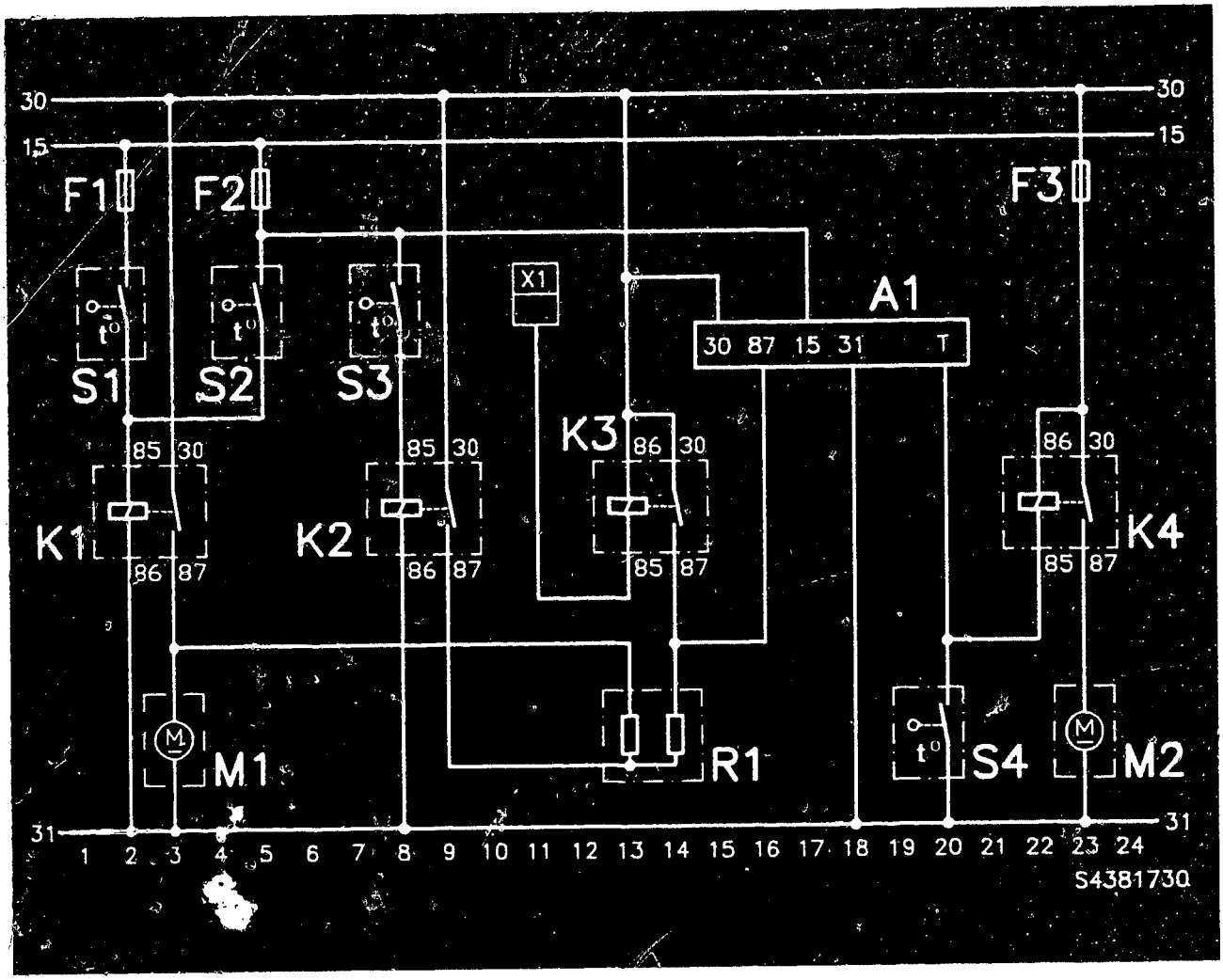
Year of manufacture 07.85->06.86:

* Connect lead 7 (red/brown) to lead at connection 87 K on relay plate.
* Connect lead 5 (red/blue) to lead in cavity 6 of relay frame for injection-valve cooling blower.

* Provide intermediate coupling of white plug connection of battery wiring harness (beneath relay plate) and red lead from cavity 2 of auxiliary wiring harness (housing 3 and 4).

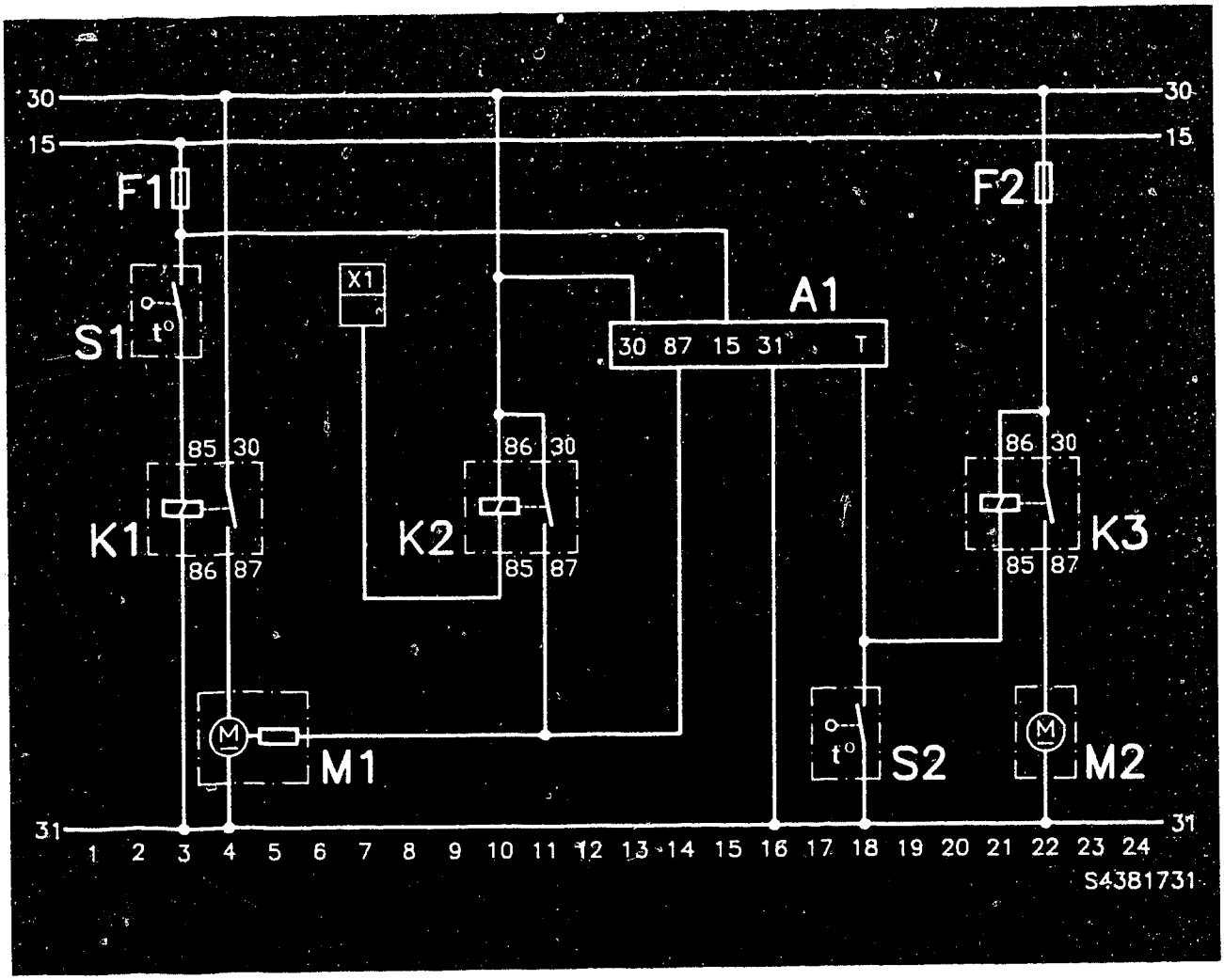
Year of manufacture 07.82->06.84:

* Attach red lead from cavity 2 of auxiliary wiring harness to free terminal 30.



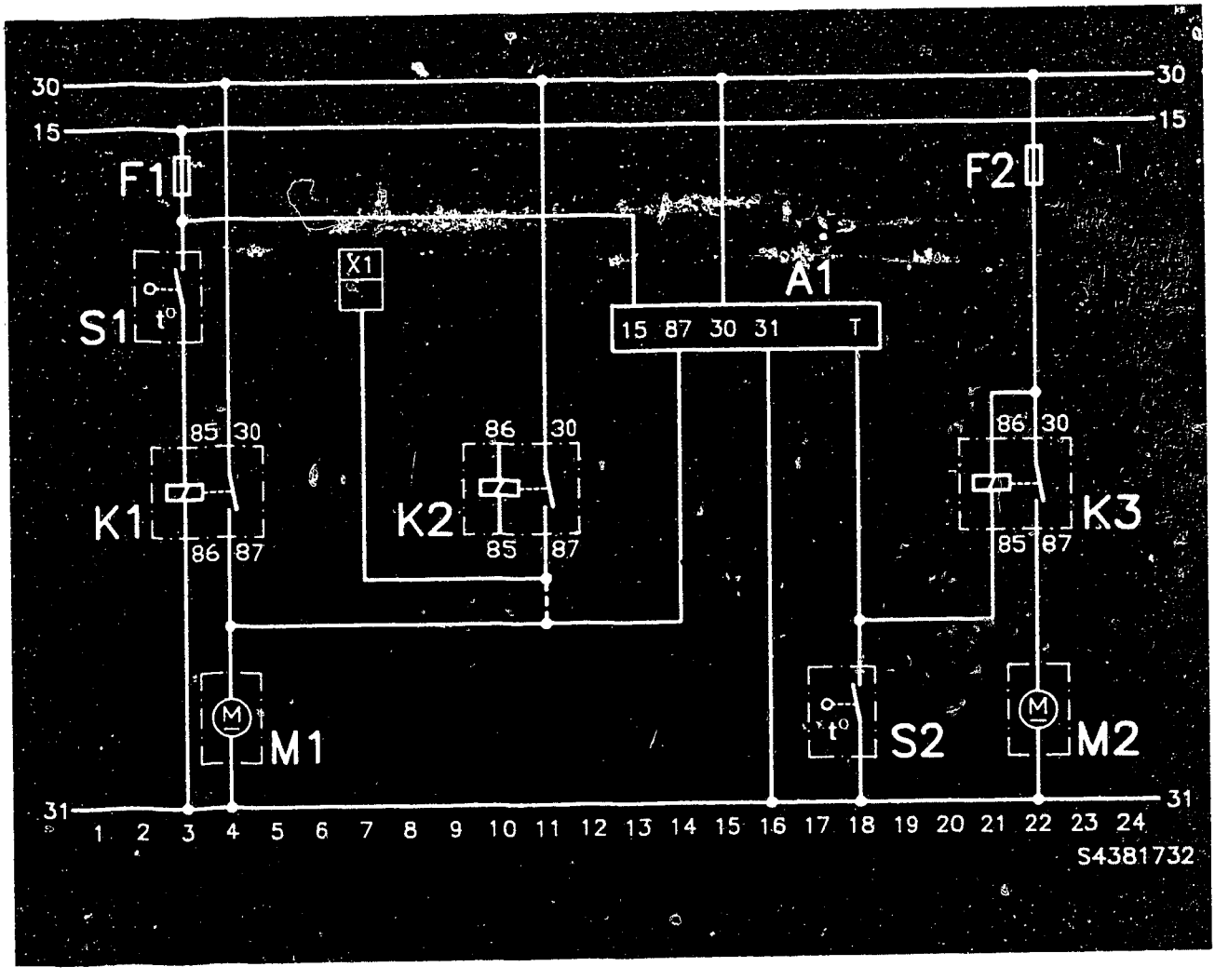
A1 = Control unit for radiator fan run-on
F1 = Fuse 30 A
F2 = Fuse 15 A
F3 = Fuse 25 A
K1 = Relay for radiator fan, stage 3
K2 = Relay for radiator fan, stage 2
K3 = Relay for radiator fan, stage 1
K4 = Relay for cooling blower of injection valves
M1 = Radiator fan
M2 = Cooling blower for injection valves
S1 = Thermo-switch, automatic transmission
S2 = Thermo-switch, coolant
S3 = Thermo-switch, coolant
S4 = Thermo-switch, air
R1 = Series resistor
X1 = Connection to control unit, coolant pump/Turbo

ELECTRICAL TERMINAL DIAGRAM AUDI 200 TURBO 07.85 -> 06.86



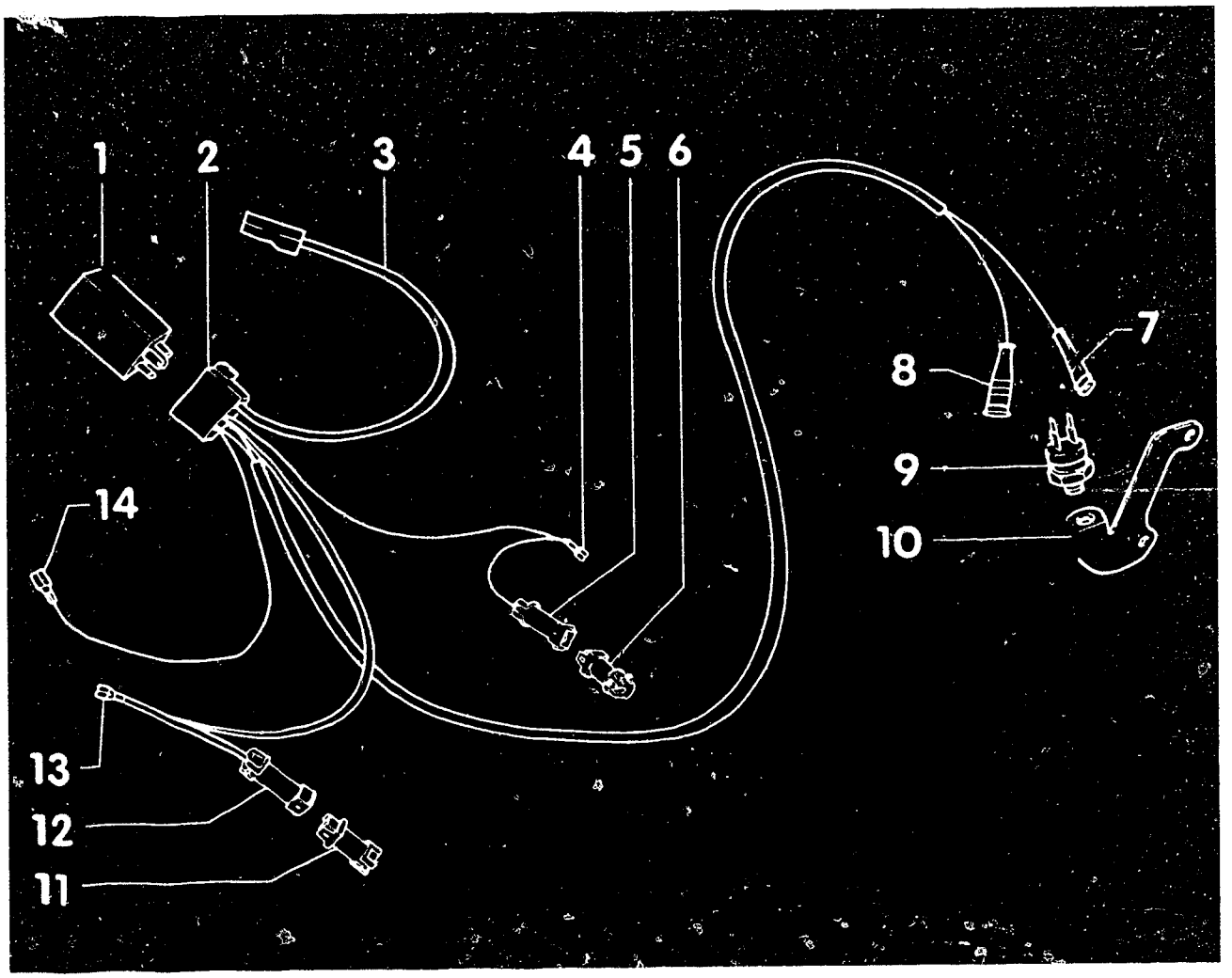
A1 = Control unit for radiator fan run-on
F1 = Fuse 15 A
F2 = Fuse 25 A
K1 = Relay for radiator fan, stage 2
K2 = Relay for radiator fan, stage 1
K3 = Relay for cooling blower of injection valves
M1 = Radiator fan
M2 = Cooling blower for injection valves
S1 = Thermo-switch, coolant
S2 = Thermo-switch, air
X1 = Connection to control unit, coolant pump/Turbo

ELECTRICAL TERMINAL DIAGRAM AUDI 200 TURBO 07.84 -> 06.85



A1 = Control unit for radiator fan run-on
F1 = Fuse 15 A
F2 = Fuse 25 A
K1 = Relay for radiator fan
K2 = Relay for radiator fan, stage 2 (only for vehicles with air conditioner)
K3 = Relay for cooling blower of injection valves
M1 = Radiator fan
M2 = Cooling blower for injection valves
S1 = Thermo-switch, coolant
S2 = Thermo-switch, air
X1 = Connection to series resistor for radiator fan

ELECTRICAL TERMINAL DIAGRAM AUDI 200 TURBO 07.82 -> 06.84



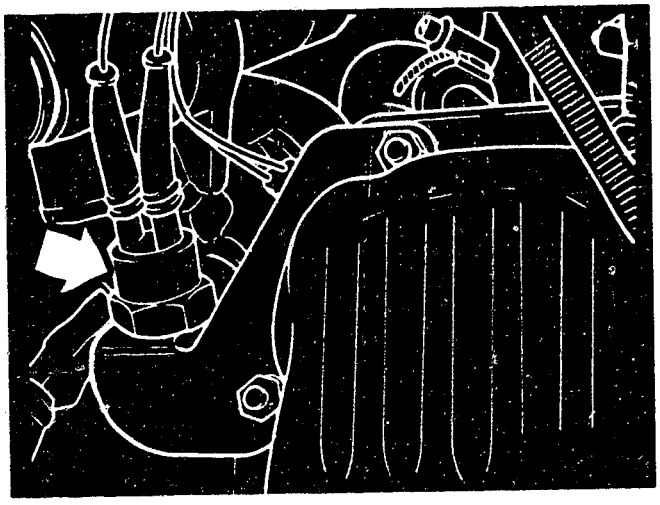
1 = Control unit for radiator fan run-on
2 = Control-unit base
3 = Lead (red 4.0 mm2)
4 = Lead (blue/red 0.5 mm2)
5 = Housing (green)
6 = Housing (green)
7 = Lead (brown)
8 = Lead (brown/green)
9 = Thermo-switch
10 = Holder
11 = Housing (gray)
12 = Housing (gray)
13 = Lead (red/black)
14 = Lead (brown)
15 = Sticker (not illustrated)

SUPPLEMENTARY EQUIPMENT SET AUDI 100 -> 06.84

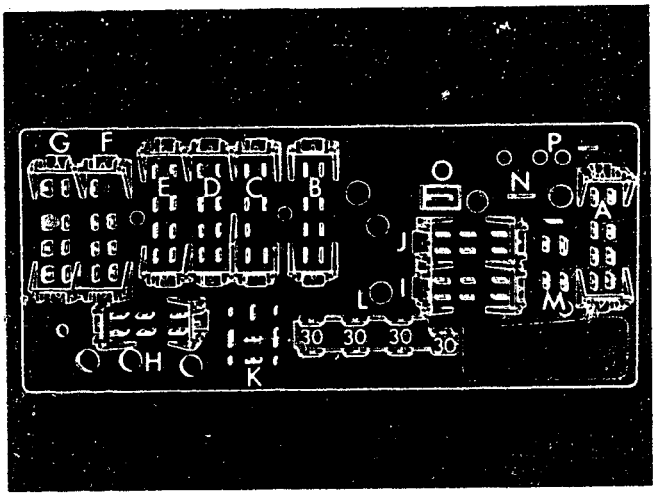
INSTALLATION INSTRUCTIONS FOR
AUDI 100

* Attach thermo-switch 9 (arrow) with holder 10 to cylinder head cover, rear

* Lay lead 7/8 to thermo-switch



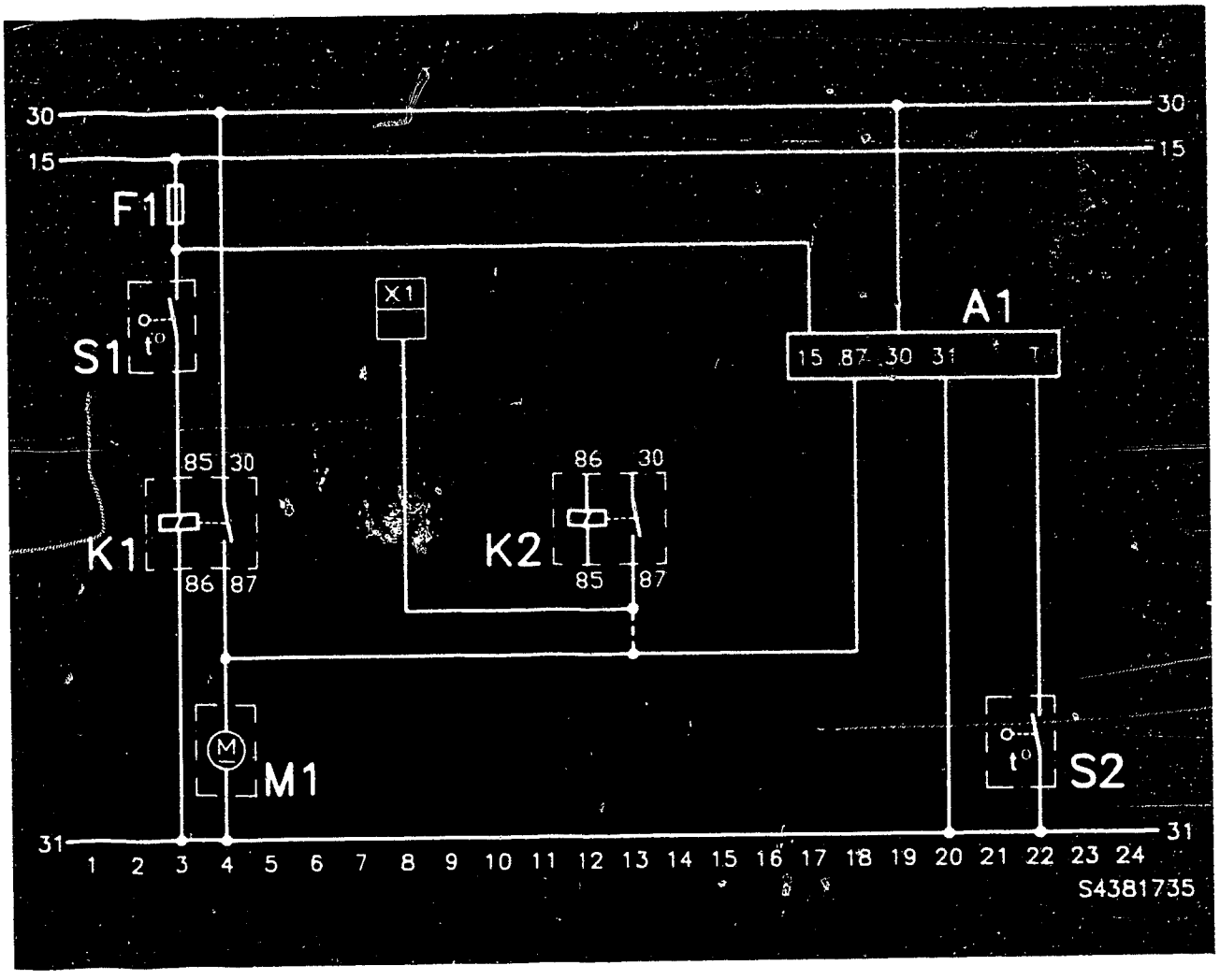
* Connect lead 4 (blue/red) to lead in cavity 2 of green 8-contact plug.
* Attach lead 3 to free terminal 30.
* Attach brown lead 7 to ground star.
* Attach control-unit base with control unit to relay plate.



Additional installation instructions

With no air conditioner:
* Connect lead 13 (red/black) to lead in cavity 7 of yellow 8-contact plug.

With air-conditioner:
* Connect lead 13 (red/black) to lead in cavity 1 of gray 8-contact plug.



A1 = Control unit for radiator fan run-on
F1 = Fuse 15 A
F2 = Fuse 25 A
K1 = Relay for radiator fan
K2 = Relay for radiator fan, stage 2 (only for vehicles with air conditioner)
M1 = Radiator fan
S1 = Thermo-switch, coolant
S2 = Thermo-switch, air
X1 = Connection to series resistor for radiator fan

ELECTRICAL TERMINAL DIAGRAM AUDI 100 --> 06.84

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents
to our authorized representative in your country

BLEEDING OF BRAKE SYSTEM

Vehicle: Passenger car
10.1988

0129 En

Various inquiries have shown that customers often complain about brake pedals being too "soft" after the brake system has been bled.

This is frequently due to the bleeder device having too high a pressure (often 2 bar and above).

Investigations have shown that air bubbles may form even at a bleeding pressure of 2 bar.

If such complaints are received, we recommend repeating the bleeding process at a pressure of 1 bar.

Bleeding should be preceded by:

* Drawing off of the old brake fluid in the reservoir,
* Cleaning of the reservoir with ethanol,
* Complete filling of the reservoir with new brake fluid.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country

Brief description of system

The airbag and seat-belt tightener represent additional safety systems designed to protect the driver and front passenger in the event of an accident (frontal impact at specified impact angles).

The vehicle deceleration is determined by means of an acceleration sensor in the trigger unit and compared to the pre-programmed trigger levels for the type of vehicle concerned.

If these trigger levels are exceeded in the event of an impact, the trigger unit passes a firing pulse to the firing pellets of the airbag and seat-belt tightener units.

3 trigger-unit generations have been available to date:

Airbag 1: comprising 3 components
- trigger unit 0285 001 ..
- voltage transformer 0 285 001 ..
- power stand-by 0285 100 ..

Airbag 2: comprising 2 components
- trigger unit 0285 001 ..
- power stand-by and voltage transformer 0 285 100 ..

Airbag 3:
- trigger unit (integrated voltage transformer and power stand-by) 0 285 001 ..

USED IN:

Airbag 1:	Mercedes-Benz	-> 09.87
	Audi and GM	09.86 ->
Airbag 2:	Volvo	10.86 ->
Airbag 3:	Mercedes-Benz	09.87 ->

As of the end of 1988, mercury switches are no longer to be installed in the trigger units of airbags 2 and 3.

The function of the mercury switch will be assumed by an acceleration-sensitive switch (Reed contact).

TEST CONCEPT:

For technical and safety reasons, the vehicle manufacturers perform after-sales service work on airbag 1 systems (see Technical Documentation).

The introduction of self-diagnosis in the airbag 2 and airbag 3 systems means that after-sales service work can be performed by the RB After-Sales Service Organization as well.

Faults in the system are stored in the fault memory and can be read out by way of a flashing code.

I M P O R T A N T :

Use may only be made for trouble-shooting purposes of multimeters with current limitation less than 20 mA, so as not to alter the firing behavior of the firing pellets and so as to reliably prevent unintentional triggering of the airbag.

TECHNICAL DOCUMENTATION:

* Technical Bulletin "Description of Airbag/Seat-Belt Tightener" (see Microcard Index KFZ 00.)

* Service Information "Mercedes-Benz Passenger Vehicles with Airbag and Seat-Belt Tightener" (see Microcard Index KFZ 00.)

* Trouble-shooting instructions (see Microcard Index KFZ 00.).

SYSTEM TRAINING:

Integrated in body electronics course.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country

DISC BRAKES

Vehicle: Passenger car
11.1988

Possible sources of noise

0133 En

Complaints regarding squeaky brakes are often expressed in conjunction with a change of pads.

The brake pad itself is very rarely the cause unless it is extremely worn.

If this is not the case and if the situation cannot be remedied by a change of pads and brake discs (including dressing), the following items are to be checked:

1. Is there any dirt between brake pad and brake disc?

2. Are brake discs unevenly worn or corroded?
   Film rust may form on brake discs if vehicles have not been driven for several days.

3. Are disc brake pads sticking as a result of rust, dirt or abrasion?

4. Are there any shim plates between piston and pad back-plate?

5. Are the expander springs rusted through or have they become relaxed?

6. Are 20° plates required (flat piston)?

7. Is the 20° angle correctly set (stepped piston)?

I M P O R T A N T :

As a general rule, new brake pads should only be fitted if the brake-caliper shafts have been thoroughly cleaned beforehand with a special file.

Brake-piston press-on surfaces are always to be coated with a permanently elastic, rust-inhibiting paste (copper paste) unless the pad already has an elastic back-plate.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country

BOSCH CAR ALARM 20 S

Vehicle: Passenger car
11.1988

Priming delay

0137 En

When the Car Alarm System 20 S was presented, we pointed out that the key-operated switch provided (0 342 006 006) can also be installed inside the vehicle.

For this purpose, it is necessary to program the delay times of the alarm system for the priming delay/alarm delay. Terminal C1 or C2 of the alarm relay must be connected to the ground point terminal 31.

The following times can be programmed:

C-connection grounded	C1	C2
Priming delay	25...45 sec.	25...45 sec.
Alarm delay	5... 8 sec.	10...14 sec.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country

LANCIA PRISMA DIESEL

Vehicle: Passenger car
11.1988

Complaint about "bucking when driving"
Conversion of distributor-type fuel-injection pump
0 460 494 144 (L 157)

0140 En

If complaints are received about "bucking when driving" in conjunction with the Lancia, Prisma Diesel passenger car, the situation can be alleviated by fitting the following service parts:

Item SP list	Part No.	Designation
55	1 468 522 446	Del.-vlv. assemb.
57	1 460 100 002	Plain washer
58	1 463 370 342	Fitting
68	1 463 161 766	Part-load regul.

The service parts indicated are put to series use in the dis.-type fuel-inj. pump 0 460 494 238 (L 157-1). The dis.-type fuel inj. pump L 157-1 has been installed in the above-men. vehicle since 8.88 as a successor to the L 157.

Following conversion work, the desig. of the dis.-type fuel-inj. pump is to be changed from L 157 to L 157-1. The dis.-type fuel.inj. pump is to be tested/adjusted in accordance with test-specification sheet L 157-1.

The costs of the conversion work are to be billed even during the warranty period.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country